博 士 論 文

PERFORMANCE-BASED REDEVELOPMENT OF WATERFRONT SPACE IN URBAN CORE AREAS OF CHINESE CITIES

2021 年 3 月

王　淵

WANG YUAN

Performance-based Redevelopment of Waterfront Space in Urban Core Areas of Chinese Cities

ABSTRACT

Waterfront landscape space is an integral part of the integrated metropolitan area. The core area of a city is an area where the political, economic, cultural and other public activities of a city are most concentrated. It is the main part of the urban public activity system, the core area of the urban structure and an important part of urban functions, and is the concentration of the city and the area where the city is located. It provides facilities and service space for economic, political, cultural and social activities, and is spatially different from other areas in the city. Due to its unique geographic location, spatial form, spatial structure, spatial scale and functional attributes, the research on this space planning has never stopped. Still, there is no particular study on the relationship between the human use perspective and planning design in the course of waterfront landscape space. Therefore, this study is based on the preliminary theoretical review and classical practice project analysis. Besides, three representative sample areas of Hangzhou Riverside Section, Hangzhou Canal and Shaoxing Ancient Canal were selected for on-site practice research and questionnaire collection. First-hand data were obtained. To provide different development perspectives for the planning and design of urban waterfront landscape spaces, we have developed a series of waterfront landscape spaces that are interdependent with each other.

In the first chapter, the background and purpose of the study are discussed:

(1) The importance of urban waterfront landscape space in the current urban development process is analyzed.

(2) The current status of the research is summarized.

(3) By defining the three most important concepts of the study, namely, pedestrian zone, space and behaviour, the course's purpose is discussed.

The purpose and significance of this study are discussed. The theoretical and practical research methods that will be used in the study are analyzed. Finally, the logic and content of this paper are presented.

Chapter 2 is a review of the theoretical literature related to waterfront landscape space:

(1) An academic study of the seven aspects of urban design, environmental psychology, environmental behaviour, social psychology, leisure sociology, Maslow's hierarchy of needs, and behaviourism theory is theoretical support for studying waterfront landscape spaces.

(2) People's behavioural activities are discussed, and the behavioural relationships of groups of people are analyzed in terms of characteristics, ages, and types of behaviours.

(3) The properties of space are investigated. The influence of space on human behavioural activities is discussed in terms of the nature of space, the perception of space, and the context shaped by play.

The correlation between human behaviour and space is analyzed by combining the specific characteristics of the two, and the complicated relationship between behaviour and space is discussed in terms of the distance and direction of action, the sense of freedom, privacy, boundary benefits, urban theory, territorial space and humanism.

Chapter 3, Analysis of Urban Waterfront Landscape Space, analyzes the connotation and essential characteristics of urban waterfront landscape space.

(1) The purpose and critical attributes in urban waterfront landscape space are examined. The vital qualities embodied in urban waterfront landscape space are summarized in openness, inclusiveness, sensitivity, historicity, diversity, extension and complexity of space.

(2) It classifies the waterfront landscape space from traditional landscape form and contemporary urban form, which provides the theoretical basis for selecting subsequent sample areas. The urban waterfront landscape composition is analyzed, which mainly includes the water landscape, transitional landscape, and surrounding land landscape.

(3) We discuss the water culture and its significance in the urban waterfront landscape space, analyze the regional aspects of water culture and its significant influence on urban planning, urban environment and urban image.

(4) We analyze the main landscape elements in the urban waterfront landscape space from both immaterial and material aspects.

Chapter 4, Study Case Selection and Research Perspective. The three sample areas are presented in terms of their developmental, climatic, economic, cultural, and historical functions. Secondly, in situ observation and analysis of the study sites in the three spaces are conducted, including the characteristics of the population activities in the places and the demand characteristics of the holes in which they live. Thirdly, based on the theoretical analysis and practical research, the questionnaires were designed, and the necessary distribution of the questionnaires was calculated.

In Chapter 5, the sample case data results are presented:

(1) The background of the selected areas and the main aspects of the questionnaires returned in the three sample study areas of Hangzhou Riverside Section, Hangzhou Canal Section and

Shaoxing Ancient Canal are sorted out.

(2) Field observation and field practice survey data are analyzed.

(3) The data results of the questionnaire were statistically analyzed.

(4) The essential characteristics of the big data from the three sample regions are analyzed and summarized.

Chapter 6: Comparison and Analysis of Landscape Elements of Sample Cases. Based on the on-site practical research and relevant theoretical studies, the waterfront landscape's spatial elements are divided into the following six major categories: visual landscape, service facilities, recreational facilities, comfort design, spatial integrity survey, and renovation intention survey. Finally, the data's reliability was tested, and comprehensive situation analysis of the above six categories was carried out.

Chapter 7 discusses the results of the study. From the theoretical and practical research on the waterfront landscape space, the four most critical influential factors of the waterfront landscape space are derived, namely, human behaviour, spatial fit, contextual penetration, and the urban economy's role:

(1) From the perspective of integrated sensory, functional adaptability, comfort and convenience, and vitality, we will analyze the sense of using the space from human behaviour.

(2) We analyze the compatibility of waterfront landscape space for people's activities from the perspective of publicness, participation and softness of boundaries.

(3) We analyze the influence of cultural continuity, the spirit of the place, and support of space's development by exploring the extension and penetration of the context on the waterfront landscape space.

(4) The holistic and interrelated features of behaviour, space, culture and economy within the waterfront space are explained.

Chapter 8, Summary and Outlook. First of all, the whole study's conclusions are deduced; secondly, the innovation and importance of this study are explained. Finally, it reflects on the limitations and shortcomings of the research and gives an outlook on the course's future direction.

TABLE OF CONTENTS

CHAPTER 3: SPATIAL ANALYSIS OF URBAN WATERFRONT LANDSCAPE

CHAPTER 4: RESEARCHING EXAMPLES AND ASPECTS

CHAPTER 5: SAMPLE CASE DATA RESULT PRESENTATION

CHAPTER 8: SUMMARY AND OUTLOOK

Chapter 1

INTRODUCTION-RESEARCH BACKGROUND AND RESEARCH PURPOSE

CHAPTER ONE: INTRODUCTION-RESEARCH BACKGROUND AND RESEARCH PURPOSE

1.1 Research background

People's water orientation has made the development of ancient and modern civilizations mostly show the phenomenon of "prosperity along the water", and gradually developed settlements, villages, towns, and even cities with water as the center. Many historical and cultural cities and global cities also have the advantages of long waterfront development, such as London and Paris, or domestic cities such as Shanghai, Suzhou, Wuhan, and Chongqing. In the long process of urban development, the waterfront environment has also played an important role in the formation of the urban form, the shaping of space, and the appearance of the image. The waterfront areas of many cities have become the core of the city and represent the image of the city. History, culture and socio-economic outlook [1]. The personality shaping of a city often relies on the spatial form, activity behavior and context of the waterfront to create a characteristic business card for urban development and give unlimited possibilities for the future development of the city.

Urban waterfront space is an important carrier of urban comprehensive activities. As one of the areas where human activities and the process of self-recognition work most strongly in the city, the waterfront has many functions in the natural and social systems of the city, such as water conservancy, transportation, recreation, city image and ecological functions, etc [2].In the process of urban expansion, the life, productivity, ecology, transportation convenience and cultural memory of the waterfront area make the waterfront area a distribution center for housing, production, trade, leisure and transportation. As a result, the waterfront comprehensively reflects the social, economic and cultural forms of the city, and brings strong vitality to the development of the city.

In the process of urban expansion, the life, productivity, ecology, transportation convenience and cultural memory of the waterfront area make the waterfront area a distribution center for housing, production, trade, leisure and transportation. As a result, the waterfront comprehensively reflects the social, economic and cultural forms of the city[3], and brings strong vitality to the development of the city.

With the improvement of living standards and the gradual rise of people's needs, people pay more and more attention to the waterfront area and begin to examine the development and landscape planning of the waterfront area with a more professional perspective. Each city’s river or waterfront area has its unique functions and rich culture, which determines that the landscape and spatial planning of the waterfront area should fully reflect the characteristics of the area, tolerate all possible activities in the space, and integrate Sexual analysis of the nurturing relationship between space and behavior shapes the character of the environment and the characteristics of the crowd. This article is based on the diversification of the urban waterfront space and the interaction between the behavior

of the people in the space and the environment. This article attempts to analyze the behavior and space of the people in the urban waterfront from the perspective of space and behavior. Shape the complex relationship between the two to provide reference and guidance for related design and research.

1.2 Research summary

Summary of foreign research on waterfront area:

The concept of waterfront landscape in foreign countries originated from North America in the 1960s. In the United States, the redevelopment of the waterfront re-discovered the "white sailboats under the bright sun disappeared from the city, the lively and prosperous seaside commercial street..." Come back; and the development of Europeans focuses on the protection and regeneration of the historical and cultural environment, inheriting historical and cultural elements related to the water environment, protecting the good relationship between the water and the city in the traditional waterfront space, and creating a good waterfront surrounding. In 1970, the renewal expanded to European port cities, especially London in the United Kingdom; in the 1980s, with the development of industries in Australia and Japan, the land use of the waterfront began to change, and people re-recognized the importance of waterfront space. Some "hydrophilic activities" and "hydrophilic spaces" have appeared. In July 1990, the International Water Capital Meeting passed the "Osaka International Water Capital Meeting Spirit", which showed that people began to re-recognize the potential of the urban waterfront to improve the comfort of the urban environment and enhance the characteristics of the region. With this as a sign, the revival and development of the urban waterfront have become a worldwide trend. Subsequently, in the 1990s, the renewal of the waterfront gradually spread to newly industrialized countries and developing countries, and the development, research and practice of urban waterfronts in Asian countries also made great strides.

In 1982, the Waterfront Center was founded in Washington, D.C., and the Waterfront World magazine was founded. In 1989, the University of Venice initiated the establishment of the international "waterfront city research center" and organized several international conferences. Many universities also offer courses in Waterfront Research, such as Harvard School of design. Waterfront albums have been released by relevant professional magazines, such as process architecture in 1984, progressive architecture in 1990 and landscape architecture in 1991. There are also plenty of related design monographs, such as I.L. McHarg's Design Combined with Nature published in 1969, John Ormsbee & Simmonds' landscape design learning site and design manual, and park and site Planning analyzes in detail the design cases of waterfront parks in the United States, such as Golden Cologne, and explains the application of the hydrophilic concept in its design techniques. There are also many related design monographs, such as I.L. McHarg's Design

Combined with Nature published in 1969, Landscape Architecture: A Handbook of Site Planning and Design by John Ormsbee & Simmonds, and Park and Site Planning analyzes in detail the design cases of waterfront parks in the United States, such as Golden Cologne, and explains the application of the hydrophilic concept in its design techniques.

From the perspective of the development of the waterfront landscape, the waterfronts of most countries have experienced a process of development, prosperity, and decline, from the original waterfront production to the industrialization era and then to the social transformation of the post-industrial era. The development has more contemporary and endogenous characteristics. Due to the differentiation of development and evolution in different regions, the development of the waterfront is at different stages, and there are also certain differences between exploration and academic research.

First of all, related scholars have studied the motivations of waterfront renewal and believe that in the process of waterfront renewal, the popularization of sustainable development concepts and historical and cultural protection thoughts are also important reasons for its optimization. Among them, McCarthy's research on the renewal of the Dundee waterfront in Scotland, England, shows that if there is no guidance from a policy mechanism, the results of the renewal are often not ideal[4]; Stephen's research shows that different ideological orientations of government policies will lead to differences in waterfront renewal governance models[5]. However, since the mid-1990s, the influence of the concept of sustainable development has become more and more common[6]. This has been used as the main driving force for the development of waterfront landscapes. At the same time, more countries have begun to pay attention to and protect and renew the historical relics of the waterfront. In culturally rich countries and regions, they have even formed local waterfront management and development model.

Secondly, some scholars have found that with the progress of the industrialization revolution, the conflict between land use and water use within the waterfront port has gradually become prominent, which has affected the migration of ports and internal industries[7], and from the perspective of spatial development The migration is divided into six stages: The first stage: from the ancient/middle world-the beginning of the 19th century, at this time the original port-city relationship, in terms of spatial function, the city and the port are connected as far as possible; the second stage: from the 19th century- At the beginning of the 20th century, due to the rapid development of industry, the volume of bulk cargo in the port increased in Japanese, and urban land could not meet the rapid development needs of the port, and the port city was in a rapid expansion stage; the third stage: the early 20th century, the freight terminal and industrial development Gradually consuming space and accelerating the separation of ports and cities; the fourth stage: from the 1960s to 1980s, the maritime technology reform promoted the expansion and separation of the coastal industrial zone;

the fifth stage: 1970s to 1990s, the port Reconstruction in different places releases land and water space, and the core area of the old port in the city is renewed; the sixth stage: 1980-the early 20th century, the establishment of a complex transportation system with global development changed the role of pure industrialization of the port. The relationship between the port and the city began to reconnect, and the renewal and redevelopment of the port gradually came into people's field of vision[8].

In the course of social development, the roles and functions of the waterfront are gradually changing. Huang et al. (2011) combined Green and Rigby to face the waterfront based on the three waves proposed by Toffler (agricultural era, the industrial revolution, and information revolution). The division of water area types and Valleag's summary of waterfront functions are summarized into three stages of labor value-added, production value-added, and service value-added[9]. It is believed that the current waterfront area focuses on leisure and entertainment, sightseeing and recreation. Activities such as cultural preservation, marine research and ecological experience.

However, we can find that no matter how the functions of the waterfront area change, the development of the waterfront area is still affected by the relationship between the city and the waterfront area, and we are looking for the driving force for development in between, and actively deal with the past and the present. Relationship with continuity, competition and collaboration[10].

Finally, some scholars have made comparative studies on the development and renewal models of the waterfront. From the perspective of spatial structure, it can be divided into internal reorganization and external expansion. From the perspective of function shaping, the waterfront renewal model includes three models: commercial orientation, real estate orientation and compound development; from the perspective of government participation, It can be seen that the renewal model of the waterfront shows a trend of transition from government-led to public-private partnership urban corporate governance[11].

In the mode of internal space organization, the original industrial space pattern of the waterfront area is retained, and some historical relics are protected and updated so that space retains its original characteristics, and the small-scale public space is designed and updated, Inject new business formats such as cultural tourism, service and leisure, promote the transformation of space function and restore its vitality. In the mode of outward expansion, the original industrial activities were completely moved out and commercial service industries were introduced, and the waterfront area was completely transformed in terms of space, function, and development orientation. It can be seen that regardless of the renewal model, the development of the waterfront area is closely related to commerce and real estate. It attracts people through commerce, restores activities in the space, and improves the space environment through real estate, shaping a good public space, and providing a

good place for activities. Yes, this rule can be verified by combing through well-known waterfront update cases around the world.

In the initial stage of development of the waterfront, residential and commercial spaces are often the first to be valued because they are the prerequisite and support for people to return to space. Subsequently, in the context of urban renewal seeking economic effects, commerce and real estate gradually became the leading guide for waterfront renewal, focusing on optimizing land use and maximizing return on capital gains.

In summary, the research content of the waterfront area abroad covers the development process of the waterfront area, the evolution of the relationship between the port and the city, the spatial evolution of the waterfront area, the combination of spatial functions, and the intervention factors of spatial governance. The research latitude is relatively rich. It provides a solid theoretical basis for the follow-up research of this article.

Summary of Domestic Research on Waterfront Area:

The research of urban waterfront landscape planning and design has always been a hot research field in China. Due to the natural water-oriented or exploration of water space, the key areas of waterfront planning and design research mainly focus on the development and construction of waterfronts. , Waterfront planning and design and ecological protection, etc., ignoring the waterfront and the most core elements-people, and human behavior in space, from the perspective of human behavior to study landscape planning Construction and development ensure the rationality of the space design and highlight the "people-oriented" design concept. Summarizing the domestic research status of urban waterfront landscape, the main points are as follows:

Urban Waterfront Design and Development[13]edited by Zhang Tingwei, Feng Hui, and Peng Zhiquan published by Tongji University Press in March 2002 is an earlier and systematic introduction to the urban design and development of urban waterfronts in China. In addition to introducing the motivation and basic principles of the development of urban waterfront areas, it also introduces the development of foreign waterfront areas in a larger space and conducts research and analysis on the examples.

Mou Di from Xi’an University of Architecture and Technology discusses the theoretical support of waterfront urban design from the perspective of the intersection of human settlements, geography, architecture, and aesthetics, and combines waterfront construction experience at home and abroad, from city to waterfront Propose a general design model and theoretical framework, that is, to build a harmonious development relationship between the waterfront and the overall urban spatial structure; to shape the overall image of the city’s waterfront; to build spatial environmental art in

key areas of the waterfront[14].

From the perspective of recreational science, Zhou Sheng of Central South University of Forestry and Technology systematically studied the key points and points of the landscape design for the construction of recreational space in the urban waterfront, so that the landscape and recreational behaviors were coordinated and agreed to meet the recreational needs of the crowd. Design of waterfront landscape. Based on the research of landscape ecology, landscape ecological planning, and ecological design theory, Mi Wei of Northeast Forestry University analyzed several famous domestic and foreign cases such as the planning and development of the Chicago waterfront area, the Boston Strip Park System, and Guangdong Qijiang Park. It reflects the overall planning, good continuity, natural ecological restoration, industrial wasteland reconstruction, artificial wetland construction, public participation and other aspects of the waterfront area, which provide references for the planning and design of future waterfront landscape areas[15].

Bian Suping from the Nanjing University of Technology introduced the historical development process of the waterfront area through on-site investigations and by referring to urban design theories, urban renewal theories, landscape ecology theories and other related planning theories. By studying the principles and principles of waterfront programming Implement the strategy, analyze the main landscape elements and landscape structure of the waterfront area, combine the main dynamics of the waterfront development in China, and put forward a waterfront reconstruction strategy based on sustainable development, and use the Suzhou city as an example to explain the combination of urban culture At the same time as the background, the waterfront landscape was updated and transformed[16].

Lu Feng and Xu Yuhui of the School of Architecture and Urban Planning of Chongqing University analyzed the humanity and nature of the mountain waterfront urban landscape, from four aspects: protection of natural elements, restoration of waterfront vitality, reconstruction of vertical walking system, and improvement of space practical efficiency Put forward the idea of landscape planning in line with the characteristics of mountain waterfront area[17], which has certain reference significance for other similar mountain cities.

Zhang Luhong and Xiang Yuan from the Department of Architecture of Anhui Institute of Architecture and Technology analyzed the environmental characteristics, landscape characteristics and human behavior characteristics of the urban waterfront area, combined with the waterfront landscape design practice of Tongling Lakeside Plaza, from the design principles, overall design, The method of urban waterfront landscape design is explored in terms of functional zoning, landscape composition and node design[18].

Zhao Qian from Xi’an University of Architecture and Technology analyzed the historical

evolution and existing problems of the urban waterfront area, and then analyzed the ecological environment characteristics of the urban waterfront area in the Loess Plateau region, as well as people's behavior and psychology in this environment, and concluded Principles and methods for the development of urban waterfront landscape planning in the Loess Plateau[19].

Yu Kongjian, Zhang Lei, and Liu Yujie of Peking University Landscape Architecture Research Institute took the landscape design on the banks of the Sanzao River in Cixi City, Zhejiang Province as an example to explain some concepts and methods of multi-objective landscape design for urban waterfronts, and further proposed human and nature The path of landscape design related to coordinated development[20].

With the rapid development of China's economy in the past two decades and the gradual acceleration of urbanization, the waterfront of large and medium cities, an area with high-quality natural and landscape resources, has naturally become an active area for urban human settlement activities. A large number of practices and research activities for systematic and comprehensive renovation and development of urban waterfronts have emerged. Such as the development of Shanghai's central business district on the opposite bank of the Huangpu River and the renovation of the Bund pedestrian area, the renovation of the Suzhou River area, the renovation and development of the Tianjin Haihe River, and the Chengdu Funan River treatment project. However, a considerable part of the urban waterfront has not yet been effectively transformed and developed, which is a problem that many cities still need to solve urgently. With the development of society and the improvement of urban residents' requirements for environmental quality, urban waterfront areas will inevitably become the center of attention for their unique natural environment and landscape advantages.

In summary, domestic research on waterfronts mainly focuses on the scope of the waterfront space from the perspective of urban design and ecological theory but lacks exploration of the relationship between waterfront space and people, as well as activity behaviors. And this part is the prerequisite research for exposing the vitality in the space and rationally planning the space.

1.3 Research category and perspective

The urban waterfront is one of the most sensitive areas in the urban environment. As people pay more and more attention to the urban ecological environment and the development of the city, the urban waterfront has gradually become a key area for urban development at home and abroad. The development of the waterfront has become an important way to improve the urban landscape, urban image and promote urban economic development. Among them, the pedestrian area on the riverside is an important aspect of the design of the urban waterfront. In particular, material space and public

behavior are two major research elements, and their mutual influence and interaction are more worthy of our attention. Material space is the physical expression of urban space form and the bearing of urban life, and mass behavior and urban space interact and interact with each other. Therefore, the spatial material form of the pedestrian area on the side of the river provides the possibility of evacuation and release for the mass behavior in the state of aggregation and compounding, and its unique diversity meets the selective needs of modern urban life.

From the perspective of people's hydrophilicity, in various open public spaces in the city, the unique and characteristic natural element landscapes, artificial landscapes, activity landscapes, and human landscapes in the waterfront area are all in them. The activities provide a wealth of space. At the same time, these factors also create the possibility of diversity for human activities. In the urban waterfront landscape, its constituent elements are more complicated. The behavior of the crowd, cultural and economic elements all have an impact on the space and are the main factors that constitute the vitality of the waterfront landscape. At the same time, the balance of natural ecology produced by these four aspects, the landscape degree of plant style, the availability of building retention, and the sustainability of urban development are all decisive indicators for shaping the future of space. In this process, the background of the entire social environment, people's thoughts and customs of life, the natural features around the city and the unique regional climate of the city all directly have a comprehensive impact.

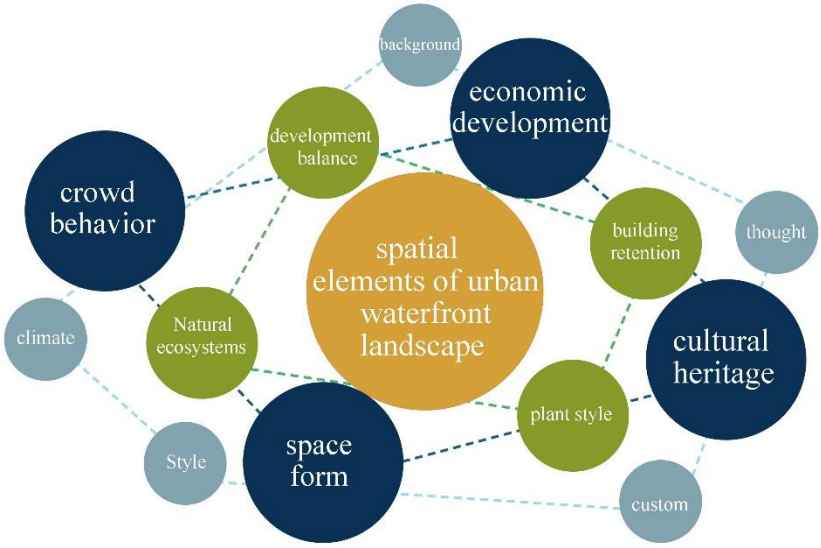

Fig. 1-1 Analysis of the elements of urban waterfront landscape

On the other hand, with the development and progress of society and the improvement of people's quality of life, the construction of urban open spaces that provide places for leisure activities is also becoming increasingly important. How to better meet the needs of users in open spaces has become

a designer The important issues facing.

Just as the goal of urban design that we advocate is to create a man-made environment and a natural environment that make human activities more meaningful, to improve the quality of human space and environment, thereby improving the quality of human life. The quality of the space environment is based on the needs of people. The quality of the space environment means the superiority of the space environment. When applied to the city, it depends on the scales that make people happy and coordinate with nature, the matching of tastes and the elimination of inconsistent contrasts. From this, we can conclude that in addition to the development and construction of the urban space material form level, urban design should also pay attention to another important level involving the visual, psychological, and behavioral connection between people and the environment, involving people's time, The sense of space and their happiness. Starting from the cultural psychology of people, studying people's experience and meaning in urban space and urban environment, as the fundamental starting point of urban design, is the thought and principle of the "connotation theory" of urban design. As Norberg Schultz once put forward, "The task of an architect is to create meaningful places to help people live." The same is true for urban design. This article will start from the perspectives of environmental psychology and behavioral psychology, and follow the theories of urban planning and urban design to systematically analyze and study the relationship between the "environment and human activities", and obtain certain design patterns and concepts arouse the awareness of urban designers to attach importance to the psychology and behavior of people in the material space.

1.4 Definition of research object concept

1.4.1 Riverfront pedestrian area

The riverside pedestrian area refers to the spatial area planned along the banks of the river in the city for people to walk and move around. Including architectural sketches, hard pavement, green planting and certain service facilities.

The riverside pedestrian area itself forms a linear space, which is an organic integration zone between the urban environment and the natural environment. However, with the improvement of the quality of the urban environment and the increasing emphasis on the development of the riverfront area, it is no longer a road space that only aims at traffic passability, but has added urban entertainment space, leisure space, cultural space, etc., and has A riverside pedestrian area formed by several enlarged nodes. It has also become an important outdoor public activity space in the city.

1.4.2 Space

For the external environment, the space concept usually refers to the scale of the area where the object is located and its specific background and atmosphere.

Different spaces will give people completely different psychological feelings. According to human senses, space can be divided into several categories. We are usually familiar with visual space, that is, the length, width, and height of a specific space. For architectural space, it is the three-dimensional proportional size of the ground, wall, and ceiling and their The size of the enclosed space, visual space occupies a dominant position in all sensory spaces, in addition to auditory space, olfactory space, tactile space, comprehensive sensory area space, cultural psychological space and so on. For example, a sculpture designed in combination with a musical fountain, because people can only hear the music played by the fountain within a range of about 5 meters, so the sculpture and the fountain are the centers of the circle, the length of 5 meters is the radius, and the sweet music is The space defining the barrier is formed. When people appreciate this sculpture, psychologically, they must rely on this musical barrier as their spatial scope. Another example is the calligraphy, inscriptions, and joints that appear in the vision, which will make people have infinite associations. The far-reaching artistic conception conveyed by "Lonely pity on the edge of the grass, with Huang Peng and deep tree ming" becomes a vision that is thought by the viewer. The resulting intangible space is a cultural psychological space. In our actual external environment, due to the complex diversity of buildings, street layouts and structures, various sense organs are mobilized to different degrees, and these sensory spaces are often mixed.

1.4.3 Behavior

Behavior is the subject's action response to a stimulus, and it is a continuous collection of purposeful actions. Human behavior simply refers to various activities in people's daily life or external human activities that can show people's thoughts, qualities, psychology, etc., or satisfy certain goals or desires. A process of step-by-step actions taken. Behaviors can generally be divided into spontaneous behaviors and acquired operational behaviors. Human behavior is fundamentally different from the behavior of other biological systems in basic characteristics. Its particularity is manifested in self-knowledge and self-control, correct behavior, use of symbols, close communication with the environment, and concern for value.

1.5 Research purpose and significance

The waterfront is a unique part of the urban space, reflecting the microcosm of each city's society, culture and economy. Since ancient times, there has been a saying in China that "there are many

people who rely on mountains, and they also need water to pass the boat and then build them". In ancient times, production technology was backward and people depended on natural water sources for their lives. The water system served the functions of defense, transportation, fire prevention, cleaning, drinking, and production. "Born with water, choose water for habitation" is the inheritance of wisdom of the ancestors. The waterfront is the center of urban life and also reflects the prosperity and civilization of the city. After the Industrial Revolution, the productivity developed tremendously, and the city has undergone earth-shaking changes, which have also caused water pollution, destruction of the natural waterfront landscape, and ecological imbalance. The waterway was replaced by the land road of “Dora, fast running”, and the traditional urban water environment was replaced by the city. "Window" becomes "Backyard". After experiencing "prosperity" and "decline", "rejuvenation" has become the main theme of contemporary urban water environment construction.

①Waterfront plays an important role in urban development and is a comprehensive space with urban characteristics.

First of all, the city’s waterfront is an important part of the construction of the city’s open space. It provides people with social, gathering, and entertainment venues. It is a space medium for information exchange and dissemination. The open space and strong historical deposits of the waterfront attract this The public yearning makes it a very characteristic part of the city's public open space. Secondly, the river is an important ecological corridor in the city. As the intermediate area connecting the river and the land, the waterfront is rich in natural resources and ecological resources. It is a sensitive part of urban ecology and an important balance line for urban ecology. Finally, the waterfront improves the habitability of the city, builds a rich urban living space based on the vitality of the water area, attracts people to yearn for it, and forms the most dynamic open space in the city.

②Provide a more humanistic research perspective for the development and planning of the urban waterfront

With the development of the city's economy, the reconstruction and development of the waterfront have always been a hot project of concern from all walks of life. With the gradual expansion of the urban construction area, after the urban space has undergone rapid extensional expansion, the connotative improvement is becoming more and more urgent, and the waterfront is a comprehensive space that meets the coordinated development of the two. This research focuses on the relationship between waterfront space and human behavior, explores to stimulate the inner vitality of urban space, exposes the humanistic logic of waterfront planning and design, and awakens the design humanity that designers should pay more attention to than space itself.

③Sampling research to build an element evaluation system for waterfront spatial design

Based on theoretical research, this research selects three samples for field investigation and questionnaire design evaluation analysis. From the specific landscape elements, it sorts out the actual practical situation of the waterfront landscape. According to the evaluation results, from the perspective of human use and space, The planning perspective and the cultural continuation perspective respectively give the analysis results to provide a basis for the rational planning of the waterfront landscape in the future.

1.6 Research methods

1.6.1 Theoretical research

Owned theories have been proved by a large number of facts, are scientific and practical, and are the basis for problem research and the generation of new theories. Therefore, the literature as the second-hand data provides the research foundation and argumentation evidence for the thesis.

In the process of the thesis research, I read various related books, periodicals, magazines, etc., especially in-depth study of the relevant literature that focuses on the current urban construction, behavior and environment in my country, and conducts an objective comprehensive analysis and comparison of these literatures, trying to grasp the main While obtaining evidence and support from other sources, the idea helps each tunnel to verify these theories through case studies.

One of the important contents of the research on waterfront landscape space and human behavior is the interaction analysis of environmental behavior. It is necessary to read and analyze related literature such as urban design, environmental behavior, environmental psychology, social psychology, and leisure sociology. To understand the interactive law of the mutual image of the urban waterfront space environment and behavior, summarize and sort it into the second chapter "Relevant Theoretical Basis" to support the relevant content of the third chapter of this article "Urban Waterfront Landscape Spatial Analysis". Combining theoretical research analysis and case background analysis to support the rationality of Chapter 4 "Research Case Selection and Research Angles" and other related content, Chapter 5 "Sample Case Data Results in Statement", Chapter 6 "Sample Case Landscape Elements" Comparative analysis" and follow-up discussions and prospects lay the foundation for theoretical research and case analysis. Among them, the theoretical study includes related photos, drawings, reports, etc. Document sources include secretaries, databases, the Internet, and related governments, social institutions and individuals.

1.6.2 Field research

Field investigation is an important means in research and analysis and an effective way to test theories. Field surveys include observations, questionnaires, interviews, and other survey methods to obtain more authentic and effective information and data. Field observations are the most basic and commonly used methods for field surveys.

Among them, the following three methods are most commonly used: systematic observation method, direct questioning method and standardized questionnaire method.

The systematic observation of environmental behavior refers to systematically observing how people use their environment? What are they doing? How are various activities related to time and space? How does the spatial arrangement affect the participants? Wait, the observation is in essence Behavior in the environment, you can obtain information about people's activities and the situational information needed to support activities, or information about site rules, behavioral norms, expected functions, and new functions, including incorrect information, or behavioral support provided in certain behavioral situations Or restrictions, etc. On-site direct observation refers to the ability to collect data as objectively as possible and to facilitate the use of statistical analysis to classify data. There is also a behavioral labeling method, which is to compile a list of possible observed behaviors according to a pilot study and classify them to get a list of activity types. Tools suitable for recording behavior observations, including oral descriptions, drawings, plans, photos or videotapes, etc. The choice of tool type mainly depends on how detailed the research topic is and how well the observer understands the behavior to be observed.

Asking questions refers to asking the research object systematically to find out what he thinks, feels and does, what he knows, believes and expects. Direct questioning is a research tool with great potential. In this way, Various data can be collected. Generally speaking, there are the following steps: Observe and understand the real situation in the interviewee's specific environment one by one to find out some of the important elements, patterns and processes, that is, the researcher has a set of hypotheses (What aspects of this situation are important to the participants? What is the significance? What impact does it have on the participants?) Based on the above analysis, the researchers formulate a questioning guide, determine the hypothesis and the main scope of the research.

A standardized questionnaire is to ask a large group of people the same set of questions, and then compare their answers. You can find commonalities and compare the differences. The standardized questionnaire provides quantitative information, so it is more convincing than qualitative information.

This study will conduct field research in two forms: questionnaires and observation interviews. The questionnaire design mainly collects the interviewees' senses of the use of space, element evaluations, and activity records. Etc., to conduct systematic information collection and recording from the two aspects of space and behavior, laying a data foundation for subsequent research and discussion.

1.6.3 Case analysis method

Based on theoretical research, this paper selects three actual cases of Hangzhou Canal Section, Hangzhou Riverside Section and Shaoxing Ancient Canal for sample research, using this as a starting point to explore the trajectories of behavior activities in different types of waterfront spaces, and obtain a large amount of data For analysis, these data will then be transformed into the premise for the discussion of the relationship between space and crowd behavior, completing the whole process from theory to practical investigation, data collection to thinking and discussion. The sample analysis of typical cases is conducive to summarizing the logical relationship between space and behavior in different types of waterfront areas, to promote the discussion results to practice and provide a reference for related planning and design.

1.6.4 Evaluation analysis

① System analysis method

System analysis is the basis of system synthesis, optimization, decision-making, and system design. The system analysis method is based on system theory, using modern scientific methods and technologies to analyze the various elements of the system of things and their interrelationships, compare, evaluate and optimize feasible solutions, to provide a reliable basis for decision-makers. System analysis has the following four characteristics: (1) Take the whole as the goal, (2) Focus on specific problems, (3) Use quantitative analysis methods, (4) Rely on value judgment.

This paper introduces the system analysis method into the study of waterfront space and behavior, regards the mutual relationship between the two as a system, and proposes the research purpose from the overall perspective to study the relationship between the system, the elements, and the environment and the regularity of changes, Establish a research model of the relationship between space and behavior from the elementary level to the environmental level, and analyze the endogenous logic of site planning. Using a combination of qualitative and quantitative methods, a comprehensive analysis of the relationship between space and behavior through value evaluation.

② Qualitative and quantitative analysis

Based on system analysis, qualitative and quantitative analyses are carried out in detail, and three types of waterfront space locations are compared and screened, and waterfront development types are divided from the nature of urban space activities to provide more latitude for research. Collect the basic data of the existing space and behavior activities in the waterfront site by designing the survey questionnaire to make preliminary preparations for the later analysis and research.

③ Multidisciplinary integrated analysis

This research is based on the waterfront space and places as the carrier, focusing on the relationship between space and crowd behavior. The research process involves urban planning and design, behavior, sociology, psychology and other disciplines. The research latitude spans multiple disciplines. Comprehensive and cross-cutting research. Aiming at the subject areas involved, this paper sorts out the related theoretical results of the previous research analyzes the main ideas of the research and conducts an integrated analysis with the topics studied in this paper to construct a more comprehensive research system on the relationship between waterfront space and behavior.

④ SPSS statistical analysis

Statistical analysis software SPSS (Statistics Package for Social Science), one of the most famous statistical analysis software in the world, can be used in data statistics of standardized questionnaire results. At the end of the 1960s, three graduate students from Stanford University developed the earliest statistical analysis software SPSS. At the same time, the SPSS company was established, and the headquarters of SPSS was established in Chicago in 1975. Before the 1980s, SPSS statistical software was mainly used in enterprises and institutions. In 1984, SPSS headquarters first launched the world's first statistical analysis software version SPSS / PC 10, which initiated the development direction of SPSS microcomputer series products, thus establishing the first position of individual users in the market. At the same time, SPSS has implemented the localization strategy and has launched nine language versions. The introduction of SPSS / PC + has greatly expanded its application scope and made it quickly applied to various fields of natural science, technical science and social science. Many influential newspapers and magazines in the world have given high praise to SPSS in terms of automatic statistical drawing, in-depth analysis of data, the convenience of use and complete functions. At present, it has gradually become popular in China. It uses windows to display various functions of data management and analysis methods, and dialog boxes show various function options. As long as you master certain windows operation skills and rough statistical analysis principles, you can use the software to serve specific scientific research work.

SPSS for windows is a combined software package, which integrates the functions of data collation and analysis. Users can select modules according to the actual needs and the functions of the computer, to meet the requirements of the system's hard disk capacity, which is conducive to the

popularization and application of the software. The basic functions of SPSS include data management, statistical analysis, chart analysis, output management and so on.SPSS statistical analysis process includes descriptive statistics, mean comparison, general linear model, correlation analysis, regression analysis, logarithmic linear model, cluster analysis, data simplification, survival analysis, time series analysis, multiple responses, etc. each category is divided into several statistical processes, such as linear regression analysis, curve estimation, logistic regression and prob It regression, weighted estimation, two-stage least squares, nonlinear regression and other statistical processes, and each process allows users to choose different methods and parameters. SPSS also has a special drawing system, which can draw various graphs according to the data.

The results of SPSS for windows are clear, intuitive, easy to learn and use, and can directly read excel and DBF data files. Now SPSS for windows and SAS. BMDP is known as the three most influential statistical software in the world. Compared with several international statistical analysis software, its superiority is more prominent. In the statistics of the overall impression scores of SAS, BMDP, GL IM, GEN STAT, EPILOG and MiniTab, the highest scores are obtained for all the functions of many users. There is an unwritten regulation in international academic circles that in international academic exchanges, the calculation and statistical analysis completed by SPSS software can be done without an explanation of algorithms. Thus, it can be seen that the impact and reputation of the algorithm are high. The latest version 12.0 adopts DAA (Distributed Analysis Architecture) and fully adapts to the Internet. It supports dynamic data collection, analysis and HTML report. However, it is difficult to be directly compatible with general office software such as office or WPS2000. When writing survey reports, it is often necessary to use spreadsheet software and professional mapping software to redraw relevant charts, which has been criticized by many statisticians; Moreover, as one of the three comprehensive statistical software, SPSS still has some deficiencies compared with the other two software, SAS and BMDP.

However, due to its simple operation, SPSS for windows has played an important role in various fields of social science and Natural Science in China. The software can also be used in economics, biology, psychology, health care, sports, agriculture, forestry, commerce, finance and other fields.

For the three most widely used statistical software SAS, Stata and SPSS, each software has its unique style and its advantages and disadvantages. The following is a brief comparative analysis.

(1)SAS

General usage: SAS is very popular with advanced users because of its powerful function and programmability. Based on this, it is one of the most difficult software to master. When using SAS, you need to write a SAS program to process data and analyze it. If there is an error in a program, it will be difficult to find and correct it.

Data management: in terms of data management, SAS is very powerful, allowing you to process your data in any possible way. It contains SQL (Structured Query Language) procedures that can be used in SAS datasets. However, it takes a long time to learn and master the data management of SAS software. In Stata or SPSS, the commands used to complete many complex data management tasks are much simpler. However, SAS can process multiple data files at the same time, which makes data management easier. It can handle 32, 768 variables, and the maximum number of records allowed by your hard disk space.

Statistical analysis: SAS can do most statistical analysis (regression analysis, logistic regression, survival analysis, ANOVA, factor analysis, multivariate analysis). SAS's advantages may lie in its analysis of variance, mixed model analysis and multivariate analysis, while its disadvantages are mainly ordered and multivariate logistic regression (because these commands are difficult) and robust methods (it is difficult to complete robust regression and other robust methods). Although it supports the analysis of survey data, the comparison with Stata is still quite limited.

Drawing function: among all statistical software, SAS has the most powerful drawing tool, which is provided by SAS / graph module. However, the learning of the SAS / graph module is also very professional and complex, and the production of graphics mainly uses program language. SAS is not as simple as SPSS, although it can draw interactively by clicking the mouse.

Conclusion: SAS is suitable for advanced users. Its learning process is hard, and the initial stage can be frustrating. However, it is favored by advanced users because of its powerful data management and the ability to process a large number of data files at the same time.

(2) Stata

General usage: Stata is popular with beginners and advanced users for its easy to understand and powerful functions. When using, you can input only one command at a time (suitable for beginners), or you can input multiple commands at a time through a Stata program (suitable for advanced users). In this way, even if there is an error, it is easier to find out and correct it.

Data management: Although Stata has less powerful data management capability than SAS, it still has many powerful and simple data management commands, which can make complex operations easier. Stata is mainly used to operate one data file at a time, which makes it difficult to process multiple files at the same time. With the introduction of Stata/SE, the variables in a Stata data file can now reach 32, 768, but when a data file exceeds the range allowed by computer memory, you may not be able to analyze it.

Statistical analysis: Stata can also perform most statistical analysis (regression analysis, logistic regression, survival analysis, analysis of variance, factor analysis, and some multivariate analysis).

Stata's greatest advantages may be in regression analysis (which includes easy-to-use regression analysis feature tools), and logistic regression (with procedures to explain the results of logistic regression, which are easy to use for ordinal and multivariate logistic regression). Stata also has a series of good robust methods, including robust regression, robust standard error regression, and other commands containing robust standard error estimation. Besides, Stata has obvious advantages in the field of survey data analysis, which can provide regression analysis, logistic regression, Poisson regression, probability regression and other survey data analysis. Its shortcomings lie in the analysis of variance and the traditional multivariate methods (multivariate analysis of variance, discriminant analysis, etc.).

Drawing function: just like SPSS, Stata can provide some command or mouse click interactive interface to draw. Unlike SPSS, it has no graphical editor. Among the three kinds of software, the syntax of its drawing command is the simplest, but its function is the most powerful. The graphic quality is also very good, which can meet the requirements of publishing. Besides, these graphs play a good role in supplementary statistical analysis. For example, many commands can simplify the making of a scatter plot in regression discrimination.

Conclusion: Stata achieves a combination of easy to use and powerful functions. Although it is easy to learn, it is very powerful in data management and many cutting-edge statistical methods. Users can easily download other people's existing programs, or write them themselves, and make them closely integrated with Stata.

(3) SPSS

General usage: SPSS is very easy to use, so it is most accepted by beginners. It has a clickable interactive interface that allows you to use the drop-down menu to select the command you want to execute. It also has a way to learn its "syntax" language by copying and pasting, but the syntax is usually very complex and not very intuitive.

Data management: SPSS has an interface friendly data editor similar to excel, which can be used to input and define data (missing values, value labels, etc.). It is not a powerful data management tool (although SPS 11 adds some commands to enlarge data files, its effect is limited). SPSS is also mainly used to operate on one file, which is difficult to handle multiple files at the same time. Its data file has 4096 variables, and the number of records is limited by your disk space.

Statistical analysis: SPSS can also carry out most statistical analysis (regression analysis, logistic regression, survival analysis, analysis of variance, factor analysis, multivariate analysis). Its advantages lie in the analysis of variance (SPSS can complete the test of a variety of special effects) and multivariate analysis (multivariate analysis of variance, factor analysis, discriminant analysis,

etc.), and the function of mixed model analysis was added in SPSS 11.5. Its disadvantages are that there is no robust method (unable to complete robust regression or obtain robust standard error), and lack of survey data analysis (spss12 version added a module to complete part of the process).

Drawing function: the interactive interface of the SPSS drawing is very simple. Once you draw a graph, you can modify it by clicking as needed. The graphics are of excellent quality and can be pasted into other files (word documents or PowerPoint, etc.). SPSS also has programming statements for drawing, but it can not produce some effects of interactive interface drawing. This statement is more difficult than the Stata statement but simpler (less functional) than the SAS statement.

Conclusion: SPSS is committed to simplicity (its slogan is "true statistics, really simple") and has achieved success. But if you're an advanced user, you'll lose interest in it over time. SPSS is a strong hand in cartography. Due to the lack of robust and survey methods, the processing of the Frontier statistical process is its weakness.

(4) Overall Evaluation

Each software has its uniqueness, but also inevitably has its weakness. In general, SAS, Stata and SPSS are a set of tools that can be used for a variety of statistical analyses. Through Stat / Transfer, different data files can be converted in seconds or minutes. Therefore, you can choose different software according to the nature of the problem you are dealing with. For example, if you want to use a mixed model for analysis, you can choose SAS; for logistic regression, choose Stata; if you want to do ANOVA, the best choice is SPSS.

In this paper, the SPSS statistical analysis method is used to analyze the data of 1200 questionnaires.

1.7 Research framework and technical route

This research first analyzes the current research background and research foundation, explains the complex relationship between urban waterfront space and crowd behavior in the order of theoretical research, case analysis, and data discussion, and analyzes its internal planning logic.

The second chapter combs the related fields involved in the research, from urban design, environmental psychology, environmental behavior, social psychology, and leisure sociology as relevant theoretical support; at the same time, it analyzes human behavior, space attributes, behavior and space The relationship provides a basis for follow-up survey questionnaire design indicators and a theoretical basis for field surveys.

The third chapter comprehensively explains the connotation of the waterfront landscape space, the regional culture and significance of the space, the classification and characteristics of the space, and the urban waterfront landscape elements that will be studied in the key waterfront area. At the same time, the fourth chapter analyzes the background and characteristics of the three cases, on-site observation analysis, survey questionnaires, and finally data analysis. The three types of waterfront landscapes are subjected to field data quantitative analysis, which lays the data foundation for the subsequent discussion and research.

The fifth and sixth chapters carry out data presentation and comparative analysis of the survey results and quantitatively classify the landscape space of the three waterfront areas from the five aspects of lighting, greening, service facilities, sports facilities and comprehensive evaluation. The evaluation of the crowd's use of space and the influence factors of space on the crowd are subdivided one by one.

Finally, Chapters 7 and 8 discuss the results based on the full-text theoretical research and the analysis of case samples. From the three aspects of people’s sense of use, the fit of the waterfront space, and the continuation and penetration of the context, the conclusion is drawn. The endogenous logic between space and behavior.

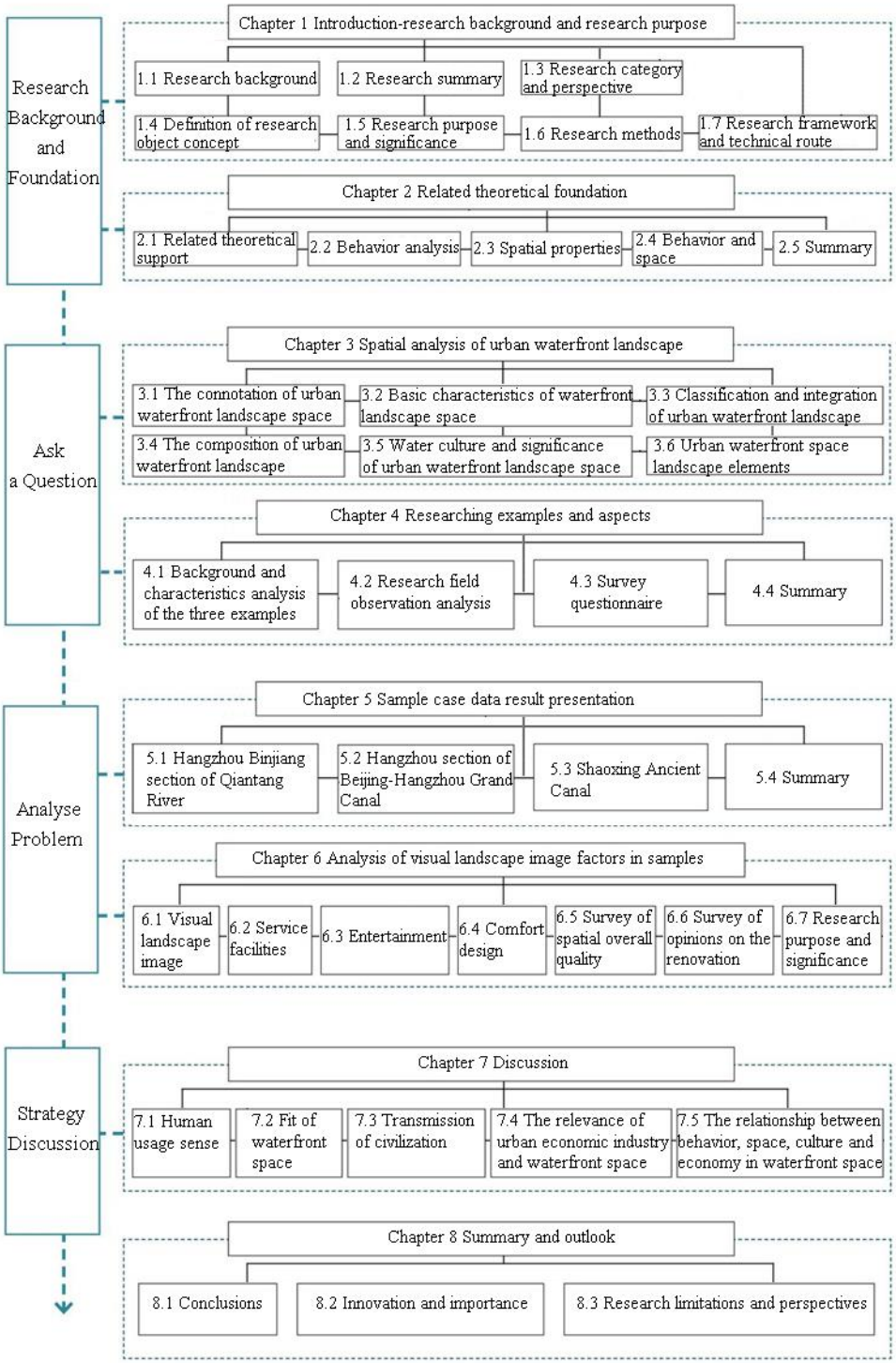

Fig. 1-2 Research framework

Reference

[1] Binyi Liu. Urban Waterfront Landscape Planning and Design [M].Southeast University Press,2006.

[2] Yi Lu. Research on the Theory and Application of Urban Waterfront Landscape Planning and Design [D]. Northeast Forestry University,2007.

[3] Hoyble B. Global and local change on the prot-city waterfront [J]. Geographical Review,2000,93(3):395-417.

[4] McCarthy J. The Dundee waterfront: A missed opportunity for planned regeneration [J]. Land Use Policy,1995,12(4):307-319.

[5] Stephen J. McGovern Evolving Visions of waterfront development in postindustrial Philadelphia : The Formative Role of Elite Ideologies [J].Journal of Planning History,2008,7(4):295-326.

[6] Vallega A. Urban waterfront facing integrated coastal management [J]. Ocean&Coastal Management,2001,44:379-410.

[7] Hoyble B. Global and local change on the prot-city waterfront [J]. Geographical Review,2000,93(3):395-417.

[8] Hoyble B. Global and local change on the prot-city waterfront [J]. Geographical Review,2000,93(3):395-417.

[9] Huang W H, Chen C H, Kao S K, Chen K Y.The concept of diverse developments in port cities[J].Ocean &Coastal Management,2011,54:381-390.

[10] Jing Gao. Metropolitan Waterfront Recreation Renewal Study [D]. East China Normal University,2015.

[11] .Mc Guckin. C. P. Brown, R. D. A landscape ecological model for wildlife enhancement of stormwater management practices in Urban greenways [J]. Landscape and Urban lanning,1995, 33(1-3)：227-246.

[12] Mok J H. The Han river renaissance: Prospects and Tasks for the Improvement of the waterfront View of The Han River [J]. International Journal of Urban Sciences,2007,11(2):185-199.

[13] Tingwei Zhang Hui Feng Zhiquan Peng.Urban Waterfront Design and Development [M], Tongji University Press, 2002.

[14] Di Mou. Zhaoqing. City Waterfront Urban Design Study [D]. Xi'an University of Architecture and Technology,2006.

[15] Marja C. Hidding. André T. J Teunissen. Beyond fragmentation：new concepts for urban-rural development [J].Landscape and Urban Planning,2002(58)：297-308.

[16] Suping Bian. Urban Waterfront Spatial Environment Renewal Study [D]. Nanjing University of Technology,2005.

[17] Feng Lu, Yuhui Xu. Reinventing Landscape Elements in Mountain Waterfront Cities - Chongqing as an Example [J]. China Garden,2006(06):61-64.

[18] Luhong Zhang, Yuan Xiang. Practice and Reflection on Urban Waterfront Landscape Design [J]. Journal of Hefei University of Technology (Natural Sciences Edition),2005(06):677-681.

[19] Qian Zhao. An Ecological Approach to Urban Waterfront Landscape Design on the Loess

Plateau [D]. Xi'an University of Architecture and Technology,2003.

[20] Kongjian Yu, Lei Zhang, Yujie Liu. Urban Waterfront Multi-Objective Landscape Design: Sanzao River Landscape Design in Cixi City, Zhejiang Province, China [J]. China Garden,2004(05):31-35.

[21] Christine A Vogt, Robert W Marans. Natural resource CS and open space in the residential decision process：a study of recent movers to fringe counties in southeast Michigan [J]. Landscape and Urban Planning, 2004(2):255～269.

[22] Jongman. R. H. G Kalvik, M, Kristiansca, I. European ecological networks and greenways [J]. Landscape and Urban Planning.2004(68)：305−319.

[23].LGE. K. HOKAO. Research on residential environmental evaluation of local cities considering regional characteristic and personal residential reference [J]. Journal of Environmental Sciences,2004, 16(1)：140−146.

[24] Kithn, M. Greenbelt and Green Heart：separating and integrating landscapes in European cityregions [J]. Landscape and Urban Planning,2003(64)：19-27.

[25] Laxwenen A. Baschak, Robert D. Brown. An ecological framework for the planning, design and management of urban river greenways [J].Landscape and Urban Planning,1995(33)：211-225

Chapter 2

RELATED THEORETICAL FOUNDATION

CHAPTER TWO: RELATED THEORETICAL FOUNDATION

2.1 Related theoretical support

2.1.1 Urban design

Urban design is the shaping of the three-dimensional material space form of the urban physical environment. Generally, it refers to the detailed planning and specific design for the construction projects shortly under the guidance of the overall urban planning. The task of urban design is to create a material environment with a certain space form for people's various activities, including various buildings, municipal public facilities, garden green space, etc., which must comprehensively reflect the requirements of society, economy, urban function, aesthetic and other aspects, so it is also called comprehensive environmental design.

The city is composed of streets, traffic and public works facilities, labor, residence, recreation and assembly system. Organizing these contents according to function and beauty principle is the essence of urban design,from F. Farjeebert, [Town Design].

Guo Enzhang proposed that the overall urban design "should conduct a special overall study on the overall urban style, landscape and spatial environment, implementation and operation mechanism, etc., in order to guide the following levels of planning and urban design", and emphasized that "the overall urban design must first Study the style and characteristics of the city[1]". Wang Jianguo believes that overall urban design is “urban design with the entire city as the research object. His work roughly includes: researching the relationship between the human environment and the natural environment in the city, mining and refining the city’s characteristic resources, and organizing it into urban development strategies. Create distinctive urban characteristics; grasp the urban spatial pattern and spatial structure form macroscopically, and propose overall control strategies for urban entrances and exits, vertical outlines, sight corridors, green open spaces and other system elements; organize meaningful behavioral place systems and build cities The overall and social-cultural atmosphere[2]."

It can be seen that urban design is a variety of reasonable treatments and artistic arrangements for the urban environment. —Excerpted from [Encyclopedia Britannica] is a comprehensive design path that satisfies the use of the city, reflects the characteristics of the city's space, and taps the cultural connotation of the city.

2.1.2 Environmental psychology

Environmental psychology is a discipline that studies the relationship between the physical environment and human behavior. It includes research and practice that use and promote this process

and improve the quality of environmental design.

Environmental psychology studies the interaction between people and the environment. In this interaction, individuals change the environment. In turn, their behaviors and experiences are also changed by the environment. They are involved in the issue of "nature-health" relatively early [3]. The main research was initiated and led by two research teams: S.Kaplan, R.Kaplan and R.S.Ulrich. From a cognitive perspective and the Ulrich team from an evolutionary perspective, the two research teams have established a complete research system, and based on research designs such as crowd experiments, they have more consistently revealed the role of the natural environment on mental recovery.

①Related research from cognitive perspective

Originated in the 1970s and 1980s, Kaplan and his collaborators used a two-week wilderness survival training to continuously track the emotional and cognitive effects of wilderness experiences over a period of more than 10 years. Their series of results show that compared with the control group, the participants' positive emotions, self-confidence, independence, self-evaluation and outdoor survival skills before and after participating in the training have been significantly improved [4] [5]. Based on this research, the Kaplans proposed the concept of "restorative environments" and constructed the "attention restorative theory" (ART) [6]. Here, the "recovery" defined by the Kaplans specifically refers to the recovery of mental fatigue related to the loss of directed attention. Another important scholar, T. Hartig, believes that it is too limited and does not fully include natural health effects. They further elaborated "recovery" as the process of renewal, recovery or reconstruction of the declining physical, psychological and social abilities of individuals in the process of striving to meet various adaptive needs, not just recovery from mental fatigue [7].

②Relevant research on an evolutionary perspective

Ulrich proposed the "stress reduction theory" (SRT) in 1983 [8]. Although this theory is somewhat similar to Kaplan’s theory, it is obviously different in key parts [9]: First, it assumes that people’s initial response to the natural environment is caused by the overall structural attributes of the natural environment (such as visual complexity). Level of autonomous emotional response (affective response), rather than cognitive response involving conscious processing; secondly, it pays more attention to emotional and physiological responses caused by stressful situations, rather than directed attention lost in daily activities; in addition, it believes Restoration comes from the reduction of arousal level rather than the supplement of directed attention. The softer environmental stimuli provided by the natural environment can trigger positive emotions and prevent negative emotions, and this benefit is related to the reduction of neurophysiological arousal. Based on the

above theoretical assumptions, Ulrich and his team have carried out a lot of research on emotional and physiological responses during natural exposure. For example, comparing the natural environment and the artificial environment in a strictly controlled experimental environment, the different effects on mood, heartbeat, blood flow, blood pressure, breathing rate, brain waves, myoelectric value, etc., and confirm that the natural environment can promote relatively faster Recovery of these indicators [10] [11] [12]. Besides, a study by Ulrich published in the journal "Science" in 1984 attracted widespread attention to the medical outdoor environment [13], which confirmed that the natural window view of the hospital ward can significantly improve the patient's postoperative recovery speed [14].

2.1.3 Environmental behavior

Environmental behavior studies pay attention to the relationship and interaction between the environment and the explicit behavior of people and use some basic theories, methods and concepts of psychology to study people's activities in cities and buildings and people's responses to these environments. Feedback to urban planning and architectural design to improve the environment for human survival. In the context of environmental behavior, the interactive relationship between environment and behavior has become the core research point. On the one hand, human beings in a complex urban environment have their behavioral cognition, preference choice, and activity content and categories all affected by the environment. Restriction; on the other hand, due to the subjective initiative of human beings, human behavior also has this shaping and shaping effect on urban space. It can be seen from this that urban space itself is not a pure material space, but a comprehensive manifestation of the interaction and mutual influence between material space and human behavior [15].

2.1.4 Social psychology

Social psychology is a science that studies the individual's psychology and behavior in a certain social environment and the law of change and development and is used to guide the individual's social practice. The definition is given by David Myers in the book "Social Psychology" is: "Social psychology is a science that studies the power of the situation around us, paying particular attention to how we view and influence others. "[16]

The person studied by social psychology is a real individual in social activities. Based on the individual, this paper studies the interaction and interaction between people and observes the influence of social environment and spatial environment on individuals. In this sense, the research object of social psychology is not the society itself, but the broad sense of social people. Social

psychology and behavior involved in social psychology are personal characteristics in the social environment. The core point of view is: external social influence shapes our attitudes and behaviors, while personal attitudes and personality tendencies also shape our behaviors. Social behaviors are also biological behaviors, that is, every psychological reaction is accompanied by a Victory reaction. The research of social psychology is a comprehensive interdisciplinary research, and its principles can be applied to daily life and other subject areas.

2.1.5Leisure sociology

Leisure sociology is a branch of sociology that studies the activities of different social groups and individuals in their leisure practice and their relationship with social and economic variables. From the perspective of human victory and psychology, leisure is a necessary condition of daily life. The sociology of leisure believes that leisure should be understood as a process of "becoming a person" and the main existence for accomplishing personal and social development tasks. Space is a lasting stage in life. Leisure is freedom to be and "become"-for self and society [17].

Leisure can be summarized into three basic elements: leisure time; leisure activity; leisure state. Leisure can be regarded as a unified whole concept including the above three and can be regarded as a state existing in a period. It emphasizes that leisure is a free activity without debt conditions and its purpose. Leisure lies in the whole context of an individual. It is an integral and indispensable part of a person and has irreplaceable importance.

2.1.6 Maslow's "hierarchy of needs theory"

In the middle of the 20th century, American psychologist Maslow divided human needs into five levels and put forward the "Needs Level Theory". According to Maslow's point of view, physiological needs, security needs, belonging and love needs, respect needs, and self-realization needs are arranged in a pyramid from low to high.

For the specific content of these five basic needs, Maslow believes：

(1) Physiological needs-the most primitive and basic needs of human beings are related to individual survival and racial transmission. Such as clothing, food, shelter, and marriage.

(2) Security needs-including life needs to be secured, as well as individuals' reliance on stable social order and laws. Safety needs have emerged one after another based on physiological needs. If an individual is insecure for a long time in the process of psychological development, it will have a greater negative impact on the formation of personality.

(3) The need for belonging and love-this layer contains two basic contents. One is that individuals have a psychological need for belonging, that is, they want to belong to a certain group or group, and they want to be one of them and get other members. Caring for each other and taking care of each other; another content expresses the need for love, hoping to get the affection of family, the friendship of friends, and the love of spouse.

(4) The need for respect-Individuals hope that they have a stable position in society and that their abilities and achievements will be recognized and respected by society.

(5) The need for self-realization-everyone hopes to use their personal talents and wisdom to realize their ideas and ambitions. This is the highest human need.

Maslow believes that the interrelationships between levels need to be expressed as:

(1) The five needs are from low to high like a ladder, but this order is not strictly arranged, and various staggered situations will occur.

(2) Low-level needs are missing needs, and high-level needs are growth needs. Only the satisfaction of high-level needs is satisfactory and has a stimulating effect. Because high-level needs will never be fully satisfied, it has a long-term motivational effect. A person's life is a life process that continuously produces needs, meets needs, and then produces new needs.

Maslow believes that the satisfaction of needs develops from a low level to a high level. Only when low-level needs are met can high-level needs arise. Maslow’s theory has a certain enlightening effect on our exploration of human needs. Our service objects must first consider the needs of personal survival and safety, and then the requirements for a high-quality life, which must include respect and The need for love. When we give them the services they hope in these areas, our work will be recognized at a higher level. Maslow also proposed a new definition of the theory of "tension relief" in traditional psychology. The so-called "tension relief" refers to the state of homeostasis achieved by a person after satisfying needs. Maslow believes that this only applies to the pursuit of people's low-level motives, and the high-level motives involving people can only be explained by the concept of "growth". The so-called "growth" refers to the process of ideal transcendence. It does not seek to relieve tension, but on the contrary, it often consciously maintains tension or even creates tension to promote the development of creative potential and self-realization. Maslow also proposed that the view of "the opposition between society and the individual" should also be reviewed. If you think that people have only low-level motives and no high-level motives, you will think that the main function of society is to restrain and suppress personal motives. If you think that people have not only low-level motives but also high-level motives, you will think that the main function of society should be to promote the gradual realization of people's motives. Society not only needs to

meet people's needs, but society itself is also created by human needs.

2.1.7 Behaviorist theory

Behaviorism is a school of psychological theory that emerged in the United States in the early twentieth century. It has gone through two main stages of development, the old behaviorism represented by JB Watson before the 1930s and Thorndike after the 1930s. (EL Thorndike), Tolman (EC Tolman), Hull (CL Hu 11) and Skinner (BF Skinner) and others represented the new behaviorism.

The old behaviorist theory denies that consciousness can be used as the object of scientific research, and argues that psychology should only study behavior and should become a "science of behavior." In order to facilitate objective experimental research on behavior, Watson also advocated that the behavior of humans and animals and the environmental impact that caused the behavior should be analyzed as some of the simplest common elements, namely stimulus and response, and the regularity of the connection between the two should be studied. In this way, the response can be inferred from the stimulus, and the stimulus can be inferred from the response, to achieve the purpose of predicting and controlling behavior.

The new behaviorists Thorndike, Tolman, Hull, and others believe that most of the behaviors of animals and humans are the result of acquired learning, and they are formed by an organism encountering a certain stimulus, causing a certain behavioral response to being strengthened. result. He experimented with animals and proposed the stimulus-response connection theory and the reinforcement theory of keeping the response at a higher level. Later, Yemen applied this connection theory or reinforcement theory to human learning and believed that connection includes not only the connection between actions but also the connection between ideas, as well as the connection between actions and ideas. The sum of all connections is mental behavior. The overall.

Connection theory is not only the starting point of behaviorist theorists' educational thoughts but also a basis for social psychologists to explain and explore the mechanism of social learning and social behavior. Later, he was influenced by the new behaviorist ideology and theory. Social psychologists NE iNiller and Dollard (J. Bollard) of Yale University proposed that many human social behaviors are learned through interpersonal interaction and imitation; while Stanford University professor A. Bandura et al. proposed social learning theory. In Bandura's "Interactive Determinism of Environment, Human and Behavior", he mentioned that human social behavior is the result of information processing activities in which human internal factors (cognition) interact with the environment; Human cognition will not only affect the organization of behavior but also behavior feedback will improve the cognition and coordination function of the result: human

behavior not only changes the environment, the environment also restricts human behavior. But man is not a completely passive responder, because he forms a self-adjusting system mediated by cognition through interaction with society, which is interactively determined.

2. 2Behavior analysis

2.2.1 Behavior level

Behavior is the subject's response to the stimulus and is a continuous set of purposeful actions. Behavior can be divided into spontaneous behavior and acquired operational behavior.

Human behavior should be one of the important basis for our planning and architectural design. As the building will greatly affect the behavior of people, in the planning and design, we have to analyze the environment and behavior, at least three levels of analysis.

The first behavior is strong purpose behavior, that is, people's activities have a clear purpose and corresponding requirements, which designers generally take seriously.

The second kind of behavior is the behavior habit accompanied by the main purpose. For example, taking a shortcut from point a to point B is the main purpose. How to get to point B faster is only a secondary purpose subordinate to the main purpose. Taking a shortcut itself has the purpose of saving time and physical strength. Sometimes it is not obvious. It is just a kind of action that is used to be natural. It often takes a reminder to be aware of this habitual behavior. Excellent designers are also aware of this kind of behavior and can achieve a natural and convenient free state according to people's use psychology when designing pedestrian roads.

The third kind of behavior is the subconscious behavior accompanied by a strong purpose, an instinctive behavior. For example, in the emergency of disaster, the left turning habit is accompanied by the strong purpose behavior of escape. People have no idea why they should turn left instead of right. Once this behavior habit is related to the external environment, designers have to take it seriously. For example, if the fire stairs are designed to turn right, people will move slowly in case of disaster; if the arrangement order of the exhibition hall is a right turn, there will be people who do not know the inside information to visit in reverse unintentionally and disrupt the order.

2.2.2 Behavior set

To achieve the main purpose, a series of behaviors are called behavior sets. In most cases, we do not analyze the behavior individually, but consider the type of behavior comprehensively, that is behavior set. This has special significance for environmental design. For example, around the theme

of shopping, there will be a series of behaviors: when people enter the shopping mall, in addition to paying for goods, they also have a series of behaviors, such as understanding commodity information, appreciating high-end goods, observing popular wear, aimless sightseeing, rest and toilet. Architects should consider all factors in this behavior set when designing shopping malls, and solve them organically. Otherwise, there will be unpleasant phenomena. For example, the husband who came with his wife had no place to sit down and rest, so he had to occupy the stairwell; when the child was tired and had no place to rest, his parents had to hold him all the way. The occurrence of these behaviors makes people harm the environmental assessment of shopping malls. If designers are good at observing people's behavior and design shopping malls around the main goal and behavior set, it will not only reflect the care for people but also be more conducive to the business operation.

2.2.3 Behavior characteristics

Human behavior is fundamentally different from that of the material system and other biological systems in basic characteristics. Its particularity lies in self-awareness and self-control, correction of behavior, use of symbols, close communication with the environment and concern for value.

1. Self-awareness and self-control

A proper response to external stimuli is a characteristic of all biological systems. Human consciousness is far superior to other animals in its depth and correctness. Human beings can understand their environment and themselves. To take predictable and purposeful actions, human beings often evaluate what they observe. So in terms of creating their future and controlling their destiny, human beings are much better than other animals.

2. Corrective action

Human beings are rarely restricted by instinct. By storing confidence, putting forward new ideas, developing new technologies and tools, exerting reasoning and imagination, summing up experience, and adjusting the direction of their efforts, human beings can always meet the specific requirements of the environment.

3. Use of symbols

Animals can also respond flexibly to perceptual stimuli. But animals can't respond to the environment without stimulus signals through their thinking. The process of human thinking is the process of making ideas and ways. The so-called idea is the symbol of the invisible and imaginary object. It is because of this symbol that human beings can invent, create, foresee the future, and plan

their future behavior rationally. Moreover, after human beings can use symbols, the method of exchanging ideas and feelings between each other can be developed. Although animals can also send and receive danger signals, they can not distinguish what kind of danger signals they are, nor can they accurately transmit and discuss countermeasures.

4. Close contact with the environment

Human beings have close contact with the environment. There are social animals, but there are no cultural animals. Animals have neither values nor any material and spiritual creation and expression.

There are three characteristics in the way of communication between human and the environment: purposefulness, which is manifested in the efforts made by the human system to preserve itself and achieve its own goals; accompanied by the ability to collect information, which is the prerequisite for effective behavior; accompanied by emotion, emotion and mood. In terms of human experience, these characteristics are called pursuit, thinking and feeling, namely the desired side, cognitive side and emotional side of human behavior.

5. Concern for the value and significance of information

Human behavior is not limited to instinct - innate adaptability. Therefore, human beings must decide what kind of goal to pursue and strive to collect necessary information and master technical knowledge to achieve this goal.

In order to choose the goal and decide the means to achieve the goal, we should not only deal with a lot of information but also decide which information is valuable and which is not. To carry out these tasks is actually to understand the significance of their existence. For the system, this will happen only when there is a high degree of flexibility and the possibility of selection. Therefore, "the human body is not only an energy system but also an information processing system".

Human behavior has great potential, in the interaction with the environment will produce a variety of different types of behavior. In guiding their behavior, human beings show the tendency of friendship, cooperation, reason, initiative and goal orientation. The relationship between human behavior and the environment is interactive.

2.2.4 Analysis of activity behavior characteristics of different age groups

1. Children (0-17 years old)

Play is the main content of children's outdoor activities. Jean Piaget, a famous Swiss child

psychologist Piaget's research shows that children's cognitive ability is limited. The acquisition of children's knowledge is a process in which the subject acts on the object, while games are the main means to promote children's cognition, which can promote the psychological development of young children, exercise the abilities of feeling, perception, thinking, language and memory, and cultivate basic motor skills, such as walking, running, jumping, throwing, climbing and balancing The way of children's understanding of society at first.

It can be seen that play is an important way for children to understand the world and develop themselves. The behavioral characteristics of games can be divided into:

· Infancy ((before 2 years old): can not be independent activities, with the help of parents can be sun or toddler activities.

· Young children (3-6 years old): they have certain thinking ability and thirst for knowledge, and have begun to observe, measure, classify and think Move. Active, like racking, digging, cycling and other activities, but the ability of independent activities is weak.

· Childhood (7-12 years old): children have gone to school, mastered certain knowledge, and gradually strengthened their thinking ability. Outdoor activities increased, Not satisfied with playing in a small space, like to go to a wide range of activities, such as playing small football, playing badminton and so on. Girls are no longer willing to play games with boys. They prefer relatively quiet games, such as rubber band jumping, instant cutting or performance.

· Teenagers (12-17): children have developed morally, intellectually and physically in an all-round way. Their logical thinking ability and independent activity ability have been enhanced. They like to participate in sports activities.

2. Youth (17-44 years old)

Most of the teenagers in this age group study in school and some of them have already started working. Youth is the golden age of human beings. During this period, intelligence develops rapidly and reaches relative maturity. Knowledge gradually accumulates. The attitude towards oneself, life and society is formed. Life is gradually stable. Students, colleagues and friends often get together. For the youth, their daily recreational activities are rich and colorful, including entertainment, social intercourse, physical exercise and so on. Youth activities are often comprehensive and random.

3. Middle-aged (45-59 years old)

Adults are the mainstay of society and bear almost all responsibilities. Because the commuting time accounts for the majority of their day, and they are the main staff engaged in housework after

work, so the time for outdoor recreation activities is less, and the activity time can only be used on weekends or after dinner.

4. Old age ((over 60 years old)

According to the National Bureau of Statistics, by 2022, China's elderly population over 65 will reach 14% of the total population.and has entered the aging society. After leaving their jobs, the life center of the elderly changes from outside the family to within the family. Their activities are centered on the family, and they are more dependent on the environment and eager to get care, help and care from them.

2.3 Spatial properties

2.3.1 The nature of spatial cognition

Spatial cognition is a process composed of a series of psychological changes. Through this process, individuals can obtain information about the location and phenomenon attributes in the daily space environment, and encode, store, recall and decode the information, including direction, distance, location and organization. Spatial cognition involves the solution of a series of spatial problems, such as location determination, street system detection, road finding (or lost), selection (or abandonment) of direction information, orientation, and other spatial problems.

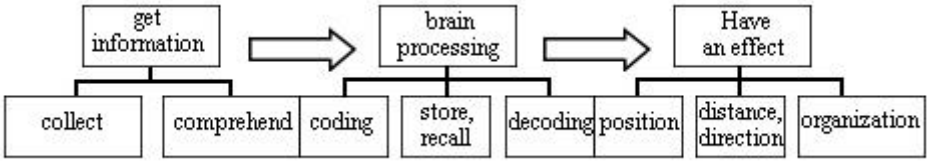

Fig. 2-1 The process of spatial cognition

2.3.2 The process of spatial cognition

Spatial cognition first relies on environmental perception. People use various senses to capture the environmental characteristics, obtain the information of a place by observing roads, features, boundaries and other environmental features, and try to find out the relationship between affairs, and understand the distance between different places and the walking route. People listen to all kinds of sounds, smell all kinds of odors, touch various objects, all of which make people know the location and environmental properties of some things.

This information is an integral part of our understanding of the environment and the basis of our

repeated contact and memory. They are stored in the brain and are ready for use in different situations. From this, we gradually understand the environment and remember the characteristics of its surroundings. Information processing is to encode and classify the information in the brain when each sense organ receives the information, and divides it into categories suitable for our experience and personality. Such a new place is self-evident marked with "something similar to something in another place." The information obtained from olfactory and tactile information can also be divided into similar or different categories, and position coding will also be set, such as "near the post office", "opposite the newsstand", etc. Information is classified and organized, compared with similar or dissimilar environments in experience, and associated with other characteristics of the environment. The encoded information can be recalled and decoded when needed. When we walk around the environment, when we talk about the environment to others, or when we determine the location of a transaction or place, this information is activated and reintegrated, and then it comes back to the brain. There are three sources of research: human ability and activities of understanding space have aroused the interest of many scholars. Scholars from three different professions have joined the academic competition, namely, urban planning, geography and psychology. The early research on spatial cognition was completed by planners and geographers. These two disciplines focused on the influence of different forms of the physical environment on spatial cognition. On the other hand, psychologists are more concerned about the individual differences of spatial cognition, such as the influence of age, gender and experience on spatial cognition. Therefore, geographers and planners emphasize results. Psychologists pay more attention to the process of spatial cognition, especially the encoding and decoding of spatial information.

2.3.3 Cognitive map

1. The nature of the cognitive map

A person with a little life experience will have a lot of space understanding of the place where he lives so that he can live and produce in the environment, Orient, locate and find the way in the environment, and understand the meaning of the environment. The key to recognize and understand the environment is to reproduce the image of the space environment in memory. Many famous theorists believe that spatial cognition is stored in the brain like a map, which floats in people's minds, and people use it just like an architectural drawing. The cognitive map can be called a mental map, mental environment or mental city. The cognitive map emphasizes the efficiency of cognition, that is, people store spatial information in a simplified form.

In a broad sense, The cognitive map is not only a map, a map on paper, it is more like a dynamic process. Through this process, one feels, classifies, remembers, recalls and interprets the space and

characteristics of his daily life and the relevant positions. In a narrow sense, the cognitive map is a structure in which people's spatial information is encoded, or at least decoded and integrated into this structure, which is equivalent to the environment it represents. The cognitive map is a form of spatial representation. It emphasizes the nature of the diagram. It is intuitive and imaginative. People construct and accumulate this brain map through years of activities and experiences. It contains a wide range of information, such as street landscape, architectural modeling, trees, water and features. Different people to the same environment, due to different activities and experiences, personality, age, social status and lifestyle, their cognitive map is not the same, but a group of people will reach a certain consensus on a certain area, which will reflect the characteristics of the environment itself to a certain extent and has reference value for environmental design.

2. The characteristics of the cognitive map

The cognitive map is not a folded picture stored in the brain, flattened out when you flip the door to use it, or a miniature navigation model that we put in front of us when we want to check the course. In fact, it is a product of brain processing. Imprecision, Gestalt and simplification are the main features of this mental map.

A lot of studies have shown that people will transform their daily environmental knowledge into relatively simple geographical forms. Xia Zuhua and Huang Weikang once conducted such a survey on May 1st square in Taiyuan: they asked residents of different genders, occupations and ages to draw the plan of the square. They found that most people's "actual feelings" are different from the objective image on the plane, and also different from the objective physical image on the ground. Among them, children's cognition is different from that of adults, and traffic policemen on the square are different from others. Their common tendency is to ignore the small differences in space. Two obvious changes are that a road with a skew angle of 75 degrees is simplified into a vertical road, and a completely asymmetric square is integrated into a completely symmetrical one. These studies on the cognitive map show that it is unnecessary, unreasonable and costly for some designers to operate on the original environment for the sake of neat, regular and symmetrical graphics. Most people's spatial representation will ignore some details of the figure, and automatically simplify and Gestalt it into a simple figure.

In addition to graphics, the expression of other aspects of space in the cognitive map is also distorted. Distance and direction may be wrongly drawn, channels and routes may be drawn too much (which may mean its importance). After being enlarged, they may be out of proportion to the original, or the places may be wrongly drawn. Some features of the place are either overemphasized or underemphasized. This shows that in the process of spatial information processing, people tend to distort some aspects of the environment when encoding, storing, decoding and integrating.

Although this cognitive schema is inaccurate, incomplete and imperfect, it is useful. It shows that we describe the environment selectively and process and organize information in a meaningful way for our life. The result is an efficient and simplified cognitive structure, which is called a cognitive map. It can help us solve a lot of space problems. The cognitive map can help people to adapt to the environment and help them orient, locate and find their way in the environment. It can help people to organize the environment layout in memory, improve the mobility of activities in the environment, and facilitate work, study, shopping and leisure activities. A clear cognitive map can help people experience the environment more effectively, make the environment more meaningful, and provide a stronger sense of stability and control for the state gate. The existing cognitive map is also the basis for further enriching and expanding environmental knowledge.

3.The elements of the cognitive map

What are the maps of this psychology made up of? This question was first proposed and systematically studied by Lynch (1960). In his landmark survey, he asked residents of Boston, Los Angeles and Jersey as subjects to introduce their cities, and then he analyzed and defined five basic elements used to form the city's appearance.

· Path -- it is the passage along which the observer often, occasionally or possibly moves. It can be a continuous and directional element such as a street, a walk, a road or a river. Other environmental elements are generally arranged along the path, and people often observe the environment while moving along the path. For most people, path is the main element in cognitive map.

·Boundary -- the boundary between two surfaces or two areas, such as the riverbank, fence, etc., which can not be penetrated, and the boundary that is indicative, symbolic and penetrable. Roads and borders are sometimes difficult to distinguish.

·Region refers to the large spatial range of cities with some common characteristics. Some areas have clear visible boundaries, some areas have no clear visible boundaries, or gradually weaken.

·Node -- it refers to some strategic places in the city, such as intersections, starting and ending points of roads, squares, stations, wharves, direction change places and transfer centers. The important characteristic of nodes is concentration, especially the concentration of purpose. The node is likely to be the center and symbol of the region.

·Landmarks - they are elements that are distinctive and stand out in the landscape. The landmark is the reference of the direction within the city or the region. It can be a tower, a curved top, a high-rise building, a mountain range, a monument, an archway, a fountain and a bridge. Some landmarks

can be used as symbols of cities.

2.3.4 Spatial context

The spatial context is complex and diverse. According to the social function of space, it can be divided into school space situation, residential space situation, factory space situation, recreation space situation, etc.; according to the size of space, it can be divided into different levels of space situation in the city. From the cultural point of view, the city itself is a cultural achievement created by people, so there exists the most complex spatial situation of urban space situation.

It is composed of five parts: environment, environment, environment, environment, environment, environment and environment. Among them, space ontology form and its entity constitution are the basic material environment characteristics of space situation; natural environment is the natural characteristics of space location; user characteristics include the quality of individual users and the characteristics of group users; the use or activity mode refers to the way users use space, including lifestyle, organizational operation, mode of operation, etc; Cultural location refers to the characteristic orientation of the region in which space is located on the common concept identity system of urban residents, and also includes the potential values of belief and religion. If we want to evaluate the quality of a spatial situation or analyze whether a spatial situation is good or bad, we can measure it from the above five basic elements. It is worth noting that the above-mentioned basic elements do not act on a single space but the comprehensive application and overall evaluation of several elements. Under certain circumstances and objectives, some factors may play a leading role in the evaluation.

The goal of urban research, planning and construction is to create an optimal urban living space situation, which is conducive to people's learning, working and living activities. Therefore, we should comprehensively consider the above-mentioned elements and their interaction, and can not ignore any of them. Otherwise, it may affect the predetermined function of the space situation and make urban space lose its value to users.

2.4 Behavior and space

2.4.1 Distance

There are two central points in Hall's (1966) near body theory. First of all, he believes that North Americans regularly use four kinds of interpersonal distance in daily communication, namely intimate distance, personal distance, social distance and public distance. People use these interpersonal distances according to the situation. Second, as an anthropologist, hall believes that

people from different cultural backgrounds have different personal spaces.

1. Intimate distance

It ranges from 0 to 18 inches. It consists of a 0 to 6 inch proximal segment and a 6 to 18 inch distal segment. Within intimate distance, the senses of vision, sound, smell, body heat and breath combine to create a real relationship with another person. In this distance, the main activities are comfort, protection, caressing, fighting and whispering. Intimate distance is only used for close people, such as close friends, lovers or spouses, relatives, etc. In North American culture, strangers and occasional acquaintances don't use this distance, except in individual regular games (such as boxing). Once a stranger enters a close distance, the other person will react, such as stepping back or giving a different look. Generally speaking, adult middle-class Americans don't use intimate distance in public. Even if they are forced to enter the distance, they often tighten their bodies to avoid touching others, and their eyes are deadlocked in one direction, Hall said.

2. Personal distance

It ranges from 1.5 to 4 inches. It consists of a proximal segment of 1.5 to 2.5 feet and a distal segment of 2.5 to 4 feet. Most of the people who are active in the recent period are familiar with and have a good relationship. Good friends often talk within this distance. Personal distance allows for a wide range of people, from more intimate to more formal conversation. This is the distance that people use in public. The personal distance can keep people's communication in a reasonably close range.

3. Social distance

It ranges from 4 feet to 12 feet. It consists of a 4 to 7-feet proximal segment and a 7 to 12 feet distal segment. This distance is often used for business and social contacts, such as face-to-face interviews across tables or at cocktail parties. Hall thinks this distance is appropriate for many social interactions, but beyond this distance, it is difficult to interact with each other. Social distance often appears in business and business occasions, that is, when there is no need for excessive enthusiasm or intimacy, including voice contact, eye contact, etc., this distance is appropriate.

4. Public distance

This distance refers to a range of more than 12 feet. It consists of a 12 to 25 feet proximal segment and a 25 feet distal segment. This distance is not commonly used by people, but usually appears on more formal occasions and is used by people of higher status. More common is in the lecture hall or classroom, teachers usually give students within this distance. The distance between the speaker in the lecture hall and his nearest audience often falls within this range. It is said that after the Yom

Kippur War. During the Arab-Israeli peace talks, the distance between the representatives of the two sides was exactly 25 feet.

In addition, some people estimate that the distance is proportional to one's height. The social distance is about 1-2 times the height, and the public distance is about 4 times the height. In other words, when the distance d between the height of a person's face ((H = 24-30cm) and the distance d between the face and the face reach D / h = 2-3, the person can only realize the appropriate distance of the face. When D / h = 4, the distance is too far for the face. Generally speaking, compared with the above three distances, communication between people is limited, mainly in the visual and auditory aspects.

Hall stressed that distance itself is not an important factor. To put it more appropriately, distance provides a medium through which a lot of communication can function. In the close distance, visual, auditory, olfactory, tactile and other senses can play a special role. With the increase of distance, vision and hearing become more and more important senses.

2.4.2 Direction

Space is abstract, but for a specific environment, that is, space is concrete. The so-called abstract space is infinite and omnidirectional, and people live in space, and the characteristics of space are shown with the human posture, that is, human posture space. People experience in this space so that space has a boundary and direction, and with a certain emotional focus, namely "care area". People in space have the direction to vomit. People in a certain position have emotional associations of up and down, front and back, left and right. For example, the top will make people associate and symbolize the sky, rise and holiness; the bottom is the foundation, the underworld and failure; the front is progress, facing and public; the last is the retreat and retrograde; the left is unreasonable and unlucky; the right is order and correctness.

The significance of studying personal directional associations is to extend human emotional associations to the environment and architecture. Directional associations show people's behavior orientation, preferences and requirements, and behavior habits. The beautifully designed towers are in line with people's desire for upward views; the altars or statues in the temples are always on high places, giving believers the feeling of admiration and fascination. The Mausoleum of Sun Yat-sen expresses Sun Yat-sen's greatness as a pioneer of the Chinese democratic revolution with a few hundred meters long, so as to arouse the respect of visitors. The sinking Nanjing Massacre Memorial Hall is in line with the painful psychology of visitors. On the riverside road, it sometimes expands to the water surface, and the hydrophilic platform cantilevered on the river surface is also trying to create a feeling of being in the water environment.

2.4.3 Domain and privacy

The so-called domain refers to a certain range of space occupied and controlled by human beings. It can not only refer to the specific space, but also the perceived general or symbolic space range. Individuals often establish their boundaries or use markers to describe the field in a certain existing environment or changing environment. These boundaries are understood and respected by other individuals. Some animals leave their scent on the trees to establish their territory boundaries. In order to maintain or expand their desks and desks, primary school students put books and pencil boxes on the corner; or use chalk and pencil to draw lines between the seats to show their field. Grabbing seats is also a kind of performance of domain possession.

Domain refers to the behavior related to the field, which is the habit of individuals (or groups) to occupy or expand a specific space and the things in space in order to meet some reasonable needs. This specific space can support people's emotions when they are active, and generate a sense of belonging through the cognition and identification of the place.

Privacy means that in some cases, individuals (or groups) require their environment to have the function of isolating external interference, that is, they can control their environment according to their ideas, so as to express their feelings and self-evaluation when they are alone, and to maintain contact with other people and the outside world when necessary.

Therefore, the meaning of privacy can also be said that individuals (or groups) want to have the freedom to control and choose to exchange information with others. When the actual privacy is lower than the ideal privacy, we will feel crowded; when the actual privacy is higher than the ideal privacy, we will feel lonely. Take residence as an example, rooms for personal use, such as bedrooms for parents and children, are generally not allowed to enter. However, rooms shared by families, such as living rooms, can be used by family members and visitors, but strangers are not allowed to enter. Because the living space is mainly a place for individuals and families to live and rest, of course, it is required to exclude the interference from the outside sightline and noise, and it is expected to establish a barrier or boundary to the interference. Social factors affect privacy, including human behavior, posture, rules and customs. Social customs make people respect the privacy requirements of individuals, especially in the public space and landscape design, more attention should be paid to creating conditions for the privacy requirements of various groups of people.

2.4.4 Boundary effect

Sociologist Jonge (1968) found in a study on seat selection in restaurants and cafes that seats with

back and wall, as well as seats that can take a panoramic view, are more popular than others, especially those by the window. Sitting there gives you a panoramic view of the interior and exterior. The waiter in the restaurant confirmed that both individual and group guests indicated that they did not like the table in the middle of the restaurant and wanted a seat against the wall.

People's preference for marginal space is not only reflected in the choice of seats, but also the choice of stay area. When people stop, they will choose to stand in the concave, corner, entrance, or near the pillar, tree, street lamp and signboard. Gehl (1991), a Danish architect, said that the columns of many urban squares in southern Europe provide obvious support for people's long stay. People stand and play on or near columns. In the ancient Italian city of Siena's Campo square, people almost stand with the column as the center. These columns are placed just on the boundary of the two areas. For this reason, Jonge put forward a distinctive boundary effect theory. He pointed out that marginal spaces such as forests, beaches, trees and hollows in the forest are all favorite places for people to stay, while the open wilderness or beach is rarely visited, unless the border area is overcrowded, which can be seen everywhere in the city. The crowd in urban space has mobility, which flows rapidly on the unobstructed path, and the pedestrian flow on the unsmooth path mostly flows slowly, while the zigzag boundary line is often the place where people stay. The more tortuous the boundary line is, the more obvious the retention effect is. In his book Model Language, Christopher Alexander concludes that "if the boundary no longer exists, then the air will never be alive."

As a place for sitting or staying, the boundary area has many obvious advantages both in practice and psychology. Personal space theory can make a perfect explanation. When people stay or sit in such areas, they are less exposed than if they choose to stay in other places. Personal space is also a kind of self-protection mechanism. When people stay in the concave, entrance, colonnade, porch and trees, streetlights and billboards, this kind of space can not only protect people, but also prevent people from being in full view, and have a good view. Especially when people's back is protected, others can only walk through, observe and oppose It's much easier.

Therefore, as a popular area of stay, the boundary space should be highly valued in the design. It is worth considering setting up appropriate environmental facilities for people to stay in, defensive space with shade, sunlight and wind and rain, trees, natural terrain, steps, colonnade and other supporting objects.

2.4.5 Place theory

Christain, Professor of architecture in Norway Based on the theory of psychology, Norberg Schulz wrote Existence, Architecture and Space and Genius Loci -Towards a phenomenology of architecture. He made great progress in the discussion of "space". He put forward the theory of place

spirit, emphasizing the social and cultural connotation and human characteristics in the urban environment, and made new research in the field of urban external space environment Contribution. He believes that: the place is a space with clear characteristics, and the task of designers is to create all kinds of meaningful places. Place space has the following characteristics:

· The reason why the place is meaningful is given by human behavior. Without the role of human beings, there is no place.

· Place is established according to the center and the boundary surrounding it. Location, behavior diagram, centripetally and closeness play a role at the same time.

· Place has an internal psychological strength, which attracts and supports people's activities. Open space is a system that regards the structure and the city as an internally coherent system, harmonizing and balancing the function, space, entity, ecological environment and behavior activities to achieve integrity.

· Image, association and behavior are the basic elements of open places.

· The material environment of the place, the image and scale of architecture and space, as well as the interesting people's activities, constitute the "place spirit" synthetically. A meaningful urban space must be carefully designed to make the environment and people interact and resonate, and emphasize people's perception, emotion and behavior in the space environment.

2.4.6 Regional space

In the design of outdoor activity space, creating regional space is also very important. The so-called regional space is the territory that individuals or groups do not move. In urban public space, some places will be repeatedly occupied by certain groups of people, so it is likely to be tacitly recognized as regional space. When outsiders invade, people will have a defensive reaction. The key to the formation of regional space lies in clear boundaries and regional differences to remind users of the scope of their occupied area. Although the outdoor activity space in the city is public, it often accommodates private activities. In these areas, people can concentrate without interference. The separation means include closed type, semi-closed type and open type. Among them, although the semi-closed type has visual communication with the outside world, the space form is still relatively closed and has a strong sense of limitation, so that others will not rush into it. Open type refers to space with clear sight and a weak sense of limitation, which can be divided by the change of height difference, the difference of ground materials and the organization of greening.

2.4.7 Humanistic spirit

The so-called humanistic spirit, from the internal sense, first of all, is to return to the original. The goal of urban design we are engaged in is not only to create a materialized urban form but also to make the created environment promote people's lives and improve their quality. Therefore, while creating urban space, designers should focus on the improvement of urban environmental quality and citizens' life. Only with good environmental quality and good urban culture can we have good urban order and good urban spatial form.

Humanistic spirit advocates a kind of genuine humanistic care and real experience of urban life, which is close to life, nature, and the public, so as to restore the true nature of things. Some designers will consciously or unconsciously fall into a circle of technical thinking: researchers pursue a theory, designers pursue a technique, and managers pursue a system and mode. But for the city, for the "people" in the city, for the "life in the city" is often lack of in-depth experience, high above, according to the technical thinking carefully build the ideal environment in mind, and try to put people's life into it. This is a kind of "non-humanistic" thought. Geddes, a humanistic thinker, once said that "we should understand things according to their original appearance and create them according to their original appearance". Designers should have keen insight into social life like writers, which is a prominent manifestation of the humanistic spirit.

According to the theory of human development, the development of technology should always depend on people. Without the care of humanity, the development of technology will be like a wild horse out of the frontier. In today's era of rapid urban development, on the one hand, we transform the urban environment and urban quality through technological progress, but at the same time, we are alert to the damage of technological development to the city. In the future, cities may develop towards globalization without borders, cultural vectors and complex. One of the main tasks of urban design is to give full play to the diversity and creativity of different regions, cultures and individuals, and fully carry forward the regional and national traditional characteristics.

2.5 Summary

This chapter mainly introduces the relevant theoretical knowledge around the topic. First of all, in the introduction of the theoretical basis, this paper briefly lists the main related discipline concepts: urban design, environmental psychology, environmental behavior, social psychology and leisure sociology. From the second section to the fourth section, according to the logical order of behavior space behavior and space, this paper elaborates and summarizes the theories related to these three parts in detail, which provides sufficient theoretical support for the following chapters.

Reference

[1] Enzhang Guo，Wantai Hu. On Overall Urban Design [J]. Journal of Harbin Architecture University.1998：99-100.

[2] Jianguo Wang，Jianqiang Yang，Junyan Yang. Approaches and Methods of Total Urban Design - An Exploration of the Wuxi Case [J]. City Planning，2011，(05)：88-96.

[3] Nordh H. Quantitative methods of measuring restorative components in urban public parks [J]. Journal of Landscape Architecture, 2012, 7(1): 46-53.

[4] Hartig T, Mang M, Evans GW.Restorative effects of natural environment experiences [J]. Environment &Behavior, 1991, 23(1): 3-26.

[5] Kaplan R. Some psychological benefits of an outdoor challenge program [J]. Environment & Behavior, 1974,6(1): 101-116.

[6] Kaplan R, Kaplan S. The experience of nature: a psychological perspective [M]. New York: Cambridge University Press, 1989.

[7] Hartig T, Evans G W, Jamner L D, et al. Tracking restoration in natural and urban field settings [J]. Journal of Environmental Psychology, 2003, 23(2): 109-123.

[8] Ulrich R S. Aesthetic and affective response to natural environment [M]. I Altman, JF Wohlwill (Eds), Behavior and the Natural Environments. New York: Plenum Press, 1983: 85-125.

[9] Hartig T, Mang M, Evans G W . Restorative effects of natural environment experiences [J]. Environment & Behavior, 1991, 23 (1): 3-26.

[10] Ulrich R S. Visual landscapes and psychological well-being [J]. Landscape Research, 1979, 4(1), 17-23.

[11] Ulrich R S, Simons RF. Recovery from stress during exposure to everyday outdoor environments [C]. J Wineman, R Barnes, C Zimring (Eds), Proceedings of the seventeenth annual conference of the environmental design research association. Washington DC: EDRA, 1986: 115-122.

[12] Ulrich R S, Simons R F, Losito B D, et al. Stress recovery during exposure to natural and urban environments [J]. Journal of Environmental Psychology, 1991(3): 201-230.

[13] Velarde M D, Fry G, Tveit M. Health effects of viewing landscapes: landscape types in environmental psychology [J]. Urban Forestry & Urban Greening, 2007, 6(4): 199-212.

[14] Ulrich R S. View through a window may influence recovery from surgery [J]. Science, 1984, 224(4647): 420-421.

[15] Yanwei Chai，et al. Spatial Behavior and Behavioral Space [M]. Nanjing: Southeast University Press.2002.

[16] David Miles，Social Psychology (8th Edition)，Beijing: People's Posts and Telecommunications Press，2006：1~7.

[17] Kelley，Translated by Ran Zhao. Toward Freedom: A New Theory in the Sociology of Leisure [M]，Kunming: Yunnan People's Press，2000，P5.

[18] Kathleen A.Cordes. Application in Recreation and Leisure: for today and future [M]. Mc Graw-hill company.2003：228-230.

[19] JAFARI JAFAR. Encyclopedia of tourism II. published by: Routledge [M]. London; New

York， 2000.

[20] Charles A. Flink, Robert M. Searns. Greenways. Washington: Island Press,1993.

[21] Ann Breen and Dick Rigby.The New Waterfront.Thames and Hudson, 1996.

[22] Tachel Carson.Silent Spring [M].Boston: Houghton Mifflin Comp.1962.

[23] R.Bruttomesso al. Waterfronts: A New Frontier For Cities on Water [J].International Center Cities On Water,1993.

[24] L. Azeo. Tome. Waterfront Development [M]. New York: Van Nostrand Reinhold Company,1989,11-13.

[25] Suzanne Barrett & Marlaine Koehler. Two Decades of Rwgeneration-making a difference on the Lake Ontario and St. Lawrence River waterfronts [J]. Ontario Planning Journal.2010(4):23-32

[26] L. Azeo Torre. Waterfront development [M]. Van Nostrand Reinhold 1989.45-52.

[27] Devall. B, Sessions G, Deep Ecology: Living as if nature Mattered [M].Salt Lake City: Peregrine Smith Books,1985.

[28] Ann Breen, Dick Righy. The New Waterfront: A Worldwide Urban Success Stry [M].Thames and Hudson,1996.110-115.

[29] P Taylor, Respect for Nature: A theory of Environmental Ethics [M]. Princeton University press,1986.

Chapter 3

SPATIAL ANALYSIS OF URBAN WATERFRONT LANDSCAPE

CHAPTER THREE: SPATIAL ANALYSIS OF URBAN WATERFRONT LANDSCAPE

3.1 The connotation of urban waterfront landscape space

The waterfront has played an important role in the development process from ancient times to the present. Whether from the perspective of life, production, ecology, or even aesthetics, the waterfront plays its unique role in the urban space system. From material supply to spiritual comfort, the waterfront space is the soul of the urban landscape.

In the current rapid development of society, the city is flooded with these reinforced concrete buildings, the roaring mechanical sounds, and artificial elements and traces are everywhere. The urban waterfront, as the median city, contains urban cultural memories. The space with natural elements has also become an important material and intangible heritage in the process of urban development. Of course, the understanding of the waterfront landscape is also tortuous, and the understanding of the waterfront landscape has also been misunderstood. For example, the straightforward approach of “cutting the bend and straightening” was adopted in the early stage, and the meandering natural river was geometrically Straight line is replaced. The original vibrant river channel is filled with artificial elements such as cement. The flowers and trees on the river bank are replaced by hard ground and architectural pieces. The elasticity of the natural ecology is lost. The river channel is unable to alleviate the changes in water flow. Floods swept the city. It has brought huge losses to the city and people. With the continuation of the concept of sustainability, we have gradually reached a reconciliation with the ecological environment, but our understanding of the waterfront landscape needs to be clearer. The connotation of the waterfront landscape is the first concept to be clarified in this study.

In the waterfront landscape space, we must first clarify the two concepts of "landscape" and "space". Space is a form of material existence relative to time and a measurable quantitative description in daily life. We should understand the waterfront space based on this concept. The waterfront space is composed of more diversified components, including natural scale and artificial scale. The largest natural scale space is water space. Secondly, there are wetlands, tidal flats, green spaces, lakes, etc., which are all unique elements in the waterfront space. The artificial scale includes riverbank dams, passages, platforms, public squares, etc. It is a spatial shaping around water conditions. Therefore, in the waterfront space, the law of space formation or shaping is based on the conditions of the water system, combined with the surrounding natural scale and the environment to intervene in artificial scales, increase functionality, and realize material space shaping. Landscape can also be called a scene. The waterfront landscape contains very rich content, including natural sceneries and artificial landscapes, natural sceneries, such as water systems, vegetation, revetments, topography, and so on. Artificial landscapes such as sculptures, sketches, gallery frames, etc. This research is aimed at the relationship between the waterfront landscape space and human behavior,

including various landscape elements in the waterfront space, and their interactions and relationships with people. Of course, with the deepening of the research, it will continue to deepen, concretely paint and expand its concepts, and have a deeper understanding of the concept of waterfront landscape.

Waterfront is a specific space in a city. It refers to “land or building adjacent to rivers, lakes, and oceans, that is, the part of water adjacent to the town. According to the nature of its adjacent waters, it can be divided into riverside and river Waterfront, lakefront and waterfront. Waterfront space: Waterfront space refers to a specific space in a city, and its concept refers to "land or buildings adjacent to rivers, lakes, and oceans; parts of towns adjacent to water bodies" (1991 edition) Oxford English Dictionary).

Through the above conceptual analysis, we can find that the main core carrier of urban waterfront landscape space is still in the space adjacent to the water body, which is also the basis of urban waterfront landscape space research. It is the delineation of the urban waterfront landscape space from a plane perspective. In terms of a specific definition, the urban waterfront landscape space refers to the specific space in the city, the landscape space adjacent to the river, lake, and the ocean, including squares, parks, and landscaped roads. It is located in the transitional section between the city and the water body and is affected by both the urban environment and the natural environment. It is the main carrier of the urban natural ecological space.

3.2 Basic characteristics of waterfront landscape space

Due to its unique geographical location and the unique traditional culture formed by the close connection with water in the historical development process, the urban waterfront has environmental characteristics that distinguish it from other areas in the city:

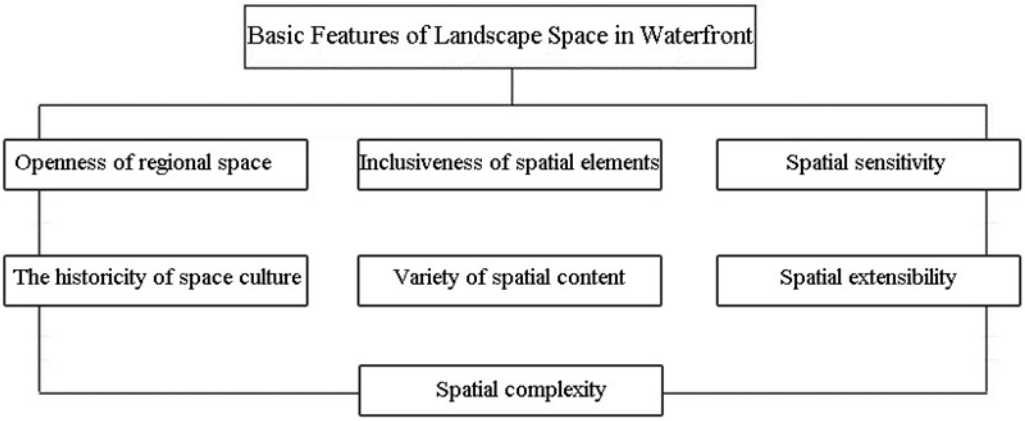

Fig. 3-1 The basic characteristics of landscape space in the waterfront area

3.2.1 Openness of regional space

From the perspective of physical space composition, the half-water and half-land spatial pattern of the waterfront is doomed to its open spatial characteristics. From the ecological point of view, the natural factors of the urban waterfront make the harmonious and balanced development between people and the environment. From a human point of view, the activity age and activity types of the people in the waterfront space are richer and more open. In short, people in the waterfront area enjoy the symbiosis with nature both spatially and spiritually. Under the concept of "shared waterfront", people have a more diverse understanding of the waterfront area.

3.2.2 Inclusiveness of spatial elements

The waterfront has abundant natural ecological resources and public activity space, providing multiple elements such as natural habitat environment and human living environment, and the space elements are highly inclusive. In the waterfront area, ecology and people have reached a balanced state of harmony and symbiosis, and even reached a certain degree of mutual interaction. For example, human beings re-plan the waterfront area based on the objective environment on the premise of respecting the ecology and create a composite space with a micro-intervention attitude, an ecologically sustainable development space, and the ecology gradually realizes the feedback to space, and the ecosystem gradually Forming a self-circulation, enriching the biodiversity of river banks and land.

3.2.3 Sensitivity of spatial properties

As a transitional area connecting waters and land, urban waterfronts are sensitive to landscape, ecology, and society. Whether the waterfront landscape is handled properly or not is directly related

to the image of the entire city. Besides, based on ecological theoretical research, areas, where two or more ecosystems meet, tend to have strong ecological sensitivity and species diversity. During the development of the waterfront, minimizing ecological disturbance has always been the primary condition, including the protection of water quality, wetlands, animals and plants, water sources, soil and other resources.

Before proceeding with the development of the Bincheng District project, an environmental impact assessment will be carried out to determine whether the project is approved for advancement. Moreover, as an important urban activity space for human beings, the waterfront is closely related to the life of citizens and has a strong sensitivity to urban life. This requires the development and design of the waterfront to take into account the requirements of both ecology and human settlement. Create a vibrant and flexible waterfront space.

3.2.4 Historicity of space culture

Most of the waterfront areas in existing cities have been extended from ancient times to the present day. They are the first places to develop and play a decisive role in the subsequent development of the city. The formation and development process of a city is also a process of cultural accumulation. The more complete the cultural preservation of the urban waterfront, the more distinctive the cultural characteristics of the city, and the more attractive the city. We can appreciate the history of the city from the rise and fall of the waterfront. In the historical port area, you can still find the remains of the ancient canal water transport, the warehouses, factories and office places leftover from industrialization, and you can still feel its history. Based on these historical traces, the waterfront landscape design can be carried out. Give a single material space a deeper cultural connotation.

3.2.5 Diversity of spatial content

The urban waterfront area includes industries, warehousing, commercial office, leisure and entertainment, residential and other functions. It is a multifunctional urban complex. From the perspective of waterfront space, it includes many spatial elements such as water body space, recreational space, waterfront functional space, and waterfront natural space. The ecological system, includes the water ecosystem, waterway symbiosis ecosystem, land ecosystem and so on. From the waterfront space activities, it includes leisure festivals, transportation, sports, sightseeing, etc. The charm of the waterfront lies in its diversified development. With the rapid development of urbanization, cities are facing an increasingly strong sense of ecological crisis, and they have begun to pay more attention to urban ecological diversity. The waterfront is the closest city to the ecological

environment. One part is an important green open space in the city. The rational development of the waterfront will play an important role in protecting the city's ecological, functional and cultural diversity. Moreover, the characteristics of the waterfront junction determine its own hydrological, ecological, social, economic, cultural, and aesthetic significance, which distinguishes the waterfront landscape from other landscapes. The design of the waterfront landscape is not only different from pure river planning and research but also different from general urban design.

3.2.6 Extensibility of spatial form

The winding characteristics of the water system determine that the waterfront area is generally a long and narrow linear space at the junction of land and water. Although its flow range is relatively wide, the general emphasis on waterfront landscape research is the constant water level or the limited space of the embankment. The waterfront area stretches along with the meandering of the river, and along with the fluidity of the river, the extensibility of the space leads to the corresponding waterfront landscape, and the space is extensible, mostly showing a linear development state. This kind of flexible extension increases the complexity of planning and design, which requires comprehensive consideration of ecological factors, space conditions, activity factors, and functional implantation.

3.2.7 Complexity of the spatial level

The waterfront landscape planning, design and construction involves various aspects such as planning guidance and control, ecological stability, social needs, economic development, and cultural heritage. The specific design content and style, methods and construction are only the most representative of these complex levels. When planning and designing, it is necessary to understand the interspersed relationship between different levels and handle the balance of each level.

3.3 Classification and integration of urban waterfront landscape

3.3.1 Waterfront landscape types based on traditional landscape forms

In the development of eastern and western cities, water bodies such as rivers and lakes play an important role in the formation of cities, the form and functions of cities. Most cities and scenic towns in the world are born with water. And Xing's is closely related to the waterfront space. Before the birth of landscape architecture, waterfront space was formed under the long influence of urban economy, politics, and culture. It was originally a landscape with practical production significance, used for defense, irrigation, or water diversion, but with the intervention of humans, So that the

waterfront landscape is gradually integrated with the urban architectural space, forming an urban landscape where ecology and life coexist. Besides, although a park in the modern sense has not yet been formed, regional agriculture and natural landscapes, including river water bodies and natural landscapes, constitute the foundation of waterfront landscapes.

①Functional landscape

Since the birth of the landscape, it has been accompanied by a certain degree of productivity. The same is true for the waterfront landscape. Its production includes not only the fishery, vegetation and other material output in the water system itself but also the transportation and production of the waters. The landscape is accompanied by the functionality of the urban waterfront space. Development, and finally form a landscape with regional characteristics.

The transformation and utilization of natural rivers by early urban residents created the earliest urban waterfront landscapes, such as small docks paved with stones, water intake points, rolling dams built with natural materials, wooden waterwheels, and brick mills, etc. . Traditional revetment treatment is also an important part of the historical waterfront landscape. The urban archaeology and the protection of historical landscapes in the east and west show us the long history and diverse expressions of traditional landscapes [1].

The diversion canal in ancient Rome was originally built as a civil engineering facility, but after it was completed, it crossed the river and formed a unique landscape. While ensuring functionality, it became a beautiful landscape line with a continuous arch. The wisteria environment of the surrounding valleys and rivers constitutes a landscape phenomenon that blends nature and history. Although its functionality has been gradually weakened, as a cultural heritage, its remains still stand in the city and become a local iconic landscape.

Dutch windmills are also a productive waterfront landscape, which reflects the adaptation and transformation of the Dutch to the natural environment in their long-term life. These windmills are scattered throughout the Dutch man-made canals and used to divert the water system of the next level of rivers. The development of the Dutch countryside has laid the foundation and, as a landmark landscape, represents the unique culture of the Netherlands.

In ancient times, many cities at home and abroad would build moats for defensive needs. The water system was used as a natural defensive barrier. Corresponding defensive facilities were built on both sides of the water system. These defensive facilities have also become part of the waterfront landscape, showing the waters. The functionality and tough charm. Such as the moat of the Forbidden City in China, during the Ming and Qing Dynasties, the Jinshui River was mainly used for court water and protection of the city walls. It is an important part of the Beijing water system.

There are many gates and dams on the river to adjust the water volume and control the flow rate. The river is now built as a landscaped river according to the plan, and it has become a place for citizens to relax and fish.

①Town waterfront landscape

The urban architectural space and the waterfront space together constitute the urban waterfront landscape. The water system travels through urban space and accompanies people's daily life. Gordon Cullen put forward the concept of the urban landscape in his famous book "Concise Urban Landscape Design", that is, the urban texture, spatial sequence, street facade, skyline, etc. formed by the combination of urban architecture and space. Landscape[2]. This concept is of great significance for the analysis and understanding of traditional waterfront landscapes. The urban waterfront is organically integrated with urban buildings and neighborhoods, and the waterfront trails and the urban connection network merge, open and closed freely to change, forming a semi-enclosed public open space, and the waterfront buildings form a distinctive urban interface. Buildings and water systems form a rich urban skyline, which are all special and important elements of the waterfront. For example, the San Antonio River Walk, where millions of people come to enjoy this unique paradise every year, after two hundred years of construction, the San Antonio River has become a scenic "underground river". The entire downtown street "floats" above the river bank. At the corner of the street, there are spiraling or modern-style stairs leading to the river, and the stairs suddenly open up.

A. Typical waterfront town-Italy

Italian towns are typical waterfront towns, the most famous of which is Venice. The buildings are built along the river, and the facades, decorations and bridges of the buildings have become the core elements of the waterfront landscape. Close to it, you can experience the rich waterfront architectural space and the connected water lanes. From a distance, you can see the city's beautiful waterfront skyline and the integration of the overall space. Many artificial elements are incorporated into the waterfront space, such as platforms, pick-out spaces, corridors, etc., but they do not disrupt the overall landscape atmosphere.

The Ponte Vecchio on the Arno River in Florence echoes the Lanzi Loggia, Uffizi Gallery, and Palazzo Vecchio, forming a flowing space interspersed with waterfront space and architecture [3].

Many waterfront towns in Italy reflect the unique Mediterranean style and culture, such as the small town of Portofino. The characteristic of the town is that the waterfront buildings are built along the foot of the mountain along with the water, conforming to the natural spatial form and forming a continuous curved interface, achieving a tacit symbiosis with nature.

Lake Como in northern Italy and the small towns on the shores of other lake regions have made full use of the natural spatial landscape advantages to forming a unique and harmonious waterfront landscape.

B. Waterfront landscape of plain water network-Netherlands

Dutch cities are located at the mouth of the plains. The traditional waterfront landscapes are mostly bricked canal edges, narrow but shaded riverside walks, and occasionally accompanied by water conservancy projects such as windmills, gates, and dams. Its landscape space scale is small but simple and practical, artificial landscape combined with natural characteristics, unique in the Netherlands, and has a strong reference value for the waterfront design of the plain water network area.

C. Towns with mountains and rivers-Germany, Switzerland, Denmark, Turkey, Sweden

Historical towns in Germany, Switzerland and other regions have formed a waterfront landscape different from southern Europe by taking advantage of mountains and rivers. Most of their towns are built along the river or lake [4]. The typical Rhine Valley, where numerous small towns and castles meet the natural landscape, form a famous Rhine trip. Among them, the Deutsches Corner near Koblenz, where the Rhine and Main rivers converge, is a famous case of traditional waterfront landscape design. Switzerland's Zurich, Geneva, Lausanne, etc. are also world-famous for their lakeside or riverside urban spatial. Copenhagen and Oslo in Northern Europe; Prague and Budapest in Eastern Europe and Istanbul in Turkey all use waterfront space to create urban landscapes. Among them, we will find that most of the waterfront landscape has become the representative image of the city, and relying on the unique landscape of the waterfront landscape, the city’s history and culture are implicitly communicated.

D. Waterfront landscape of Asian towns

Angkor Wat in Cambodia is surrounded by moats and city walls. The reflection of forests and pagodas forms the artistic conception of the waterfront landscape. India has many waterfront towns with an abundant rainy season and a strong religious culture. The historic city of Agra is a typical waterfront city. Losing the nearby Taj Mahal, standing along the Yamuna River, extends the city's landscape axis.

E. Waterfront landscape of traditional towns in China

There are many traditional waterfront towns in our country. We call them water towns. Each has its characteristics. According to the origin of the town’s prosperity, its spatial pattern has different development traces and traditional distribution patterns. However, small towns did not have rapid

industrial development and did not follow the pace of industrialization. Therefore, they still retain a relatively simple architectural space style. However, as the pace of urbanization accelerates, this change will gradually accelerate.

Zhouzhuang Town is a typical waterfront town, known as Zeguo and Zhenfengli since ancient times. The water network here is densely covered, forming a network throughout the town. The rivers here are streets. Residents live next to the water and have a quaint town atmosphere. It is a typical small bridge and flowing water town. The water network is accessible, and the water system carries multiple functions such as transportation, transportation, commerce, entertainment, and leisure. The waterfront space has the functions of life, production and social interaction. Towns are also prosperous due to the luxuriant water system.

Zhenjiang is a well-known land of fish and rice in China. It is located on the southwest coast of Jiangsu Province. It is a representative of the "urban forest". The environment has become the label of the city.

③Landscape garden and field waterfront landscape

Landscape gardens and field landscapes constitute another major type of waterfront landscape. Compared with productive functional landscapes and urban landscapes, landscape gardens are carefully planned and designed. In the early days, they were private gardens. The overall style was influenced by designers or users. The influence of personal preference will have a greater impact on subsequent park design. Such as the waterfront landscape of the Rhone Valley in Chenonceaux, France.

The field landscape is based on natural mountains and rivers, which embodies an authentic landscape form. The landscape is more simple, the water system is a natural river, and the waterfront space is mostly wild-growing animals and plants. The spatial ecological characteristics are obvious. It fluctuates freely and is a waterfront space without human intervention.

3.3.2 Waterfront landscape types based on contemporary urban forms

①Open space of urban waterfront area (new urban waterfront living area)

The modern urban waterfront landscape originated at the end of the 19th century. Because of the reflection on the erosion of the industrial concrete city, people began to pay attention to the improvement of the environment, as well as the popular garden city movement. The development of modern landscape design has further promoted people's attention to waterfront landscapes. It is worth noting that in the early days of modern landscape design, designers have noticed that urban

waterfront landscapes are not simply urban green gardens, but are integrated with functions such as flood control, improving the environment, balancing ecological relations, and promoting social communication place.

The Boston Charles River Park system as a whole presents a belt-shaped park system, which is the masterpiece of the famous American landscape architect Olmsted and a milestone in the history of landscape design. It carries out landscape planning along the Charles River basin and runs through the entire city of Boston. Modern buildings are erected by the water. Together, the buildings and the landscape constitute the city's beautiful skyline.

Most of the waterfront landscape planning in urban planning follows the same primary colors, that is, through the construction of natural and idyllic urban parks to eliminate the drawbacks of industrialized urban development, improve public health, provide sports and leisure venues, and enhance the attractiveness of the city and the comfort of living.

In addition to large-scale urban waterfront parks, European cities often promote the improvement of open space systems through gradual improvements to existing urban spaces. The establishment of human-scale spaces in high-density urban spaces will evoke Openness and humanistic cognition of space.

Lyon Rhone and Saône: The city is located between two rivers. It is the earliest urban riverfront master plan in France. The original intention was to coordinate the development of the urban area and the riverfront environment, creating a pleasant urban space that is pleasant and walkable. The waterfront space is open, using the water surface, the city skyline, and the interface landscape of the riverside street to attract people and improve the waterfront environment while adding space for activities to the city. At the same time, along with the improvement of the waterfront space, the city’s public service facilities and cultural implementation have also developed in conjunction to improve the living supporting needs of the waterfront space and make it a new living area in the city.

②Canal landscape and urban leisure space (urban cultural tourism area)

Compared with large-scale urban rivers, canals and ditches have the characteristics of small scale, artificiality, and strong controllability. These artificial canals and ditches are all due to shipping and production reasons. After the upgrading of social production methods and economic development, the use of these water conservancy facilities and waterfront space has become another trend in modern and contemporary waterfront landscapes. Most of them are closely related to waterscape design, urban environment improvement, and urban leisure and entertainment development. Many successful renovation designs not only promote the development of urban blocks but also create

new tourist spots.

A typical case is the waterfront promenade in San Antonio, Texas. The project transformed the originally abandoned canal into a densely tree-lined waterfront space with a pleasant scale. The surrounding area is rich in business and leisure facilities. It is possible to cruise on the river. You can stroll along, and the waterfront landscape is rich in chromatography.

The Cheoncheon River in Seoul, South Korea is a tributary of the Han River. It has a long history and was artificially landfilled and turned into a highway due to environmental pollution and urban development. In recent years, Seoul's development decisions have demolished roads and rebuilt the historic river course. Due to the urban space and constraints, the design retains the form of the quay wall, but through innovative design, a diversified bottom hydrophilic space has been created. Fully echo the functional characteristics of urban blocks. The height difference between the city streets and the bottom water surface space has also been eased in various ways. The surrounding citizens can easily reach the park, that is, they can sit and watch on the upper level, or stroll on the lower level to get close to the water [5].

③Landscape space to be developed in a historical waterfront area (urban waterfront area to be developed)

The redevelopment of the waterfront area is produced under the background of inland revival and industrial upgrading. The redevelopment of the historic waterfront area should be built based on respecting the historical context and fully meet the current social needs of life and ecological sustainability. On development. Increase urban leisure and entertainment functions in the historical space, promote the publicity of the waterfront area, and reshape the waterfront space form. Through the use of the waterfront, public and private spaces are balanced and win-win, which will inject new ideas into urban development. Vitality.

3.4 The composition of urban waterfront landscape

The urban waterfront landscape includes two major categories: material landscape and non-material landscape. The material landscape can be divided into three components: patch, corridor, and matrix based on ecological theory. From the perspective of urban design, it can be divided into three components: Three parts of landscape area, landscape axis and landscape node. The immaterial landscape is the perceptual knowledge formed through the activities of the people based on the material landscape. It is the spiritual support placed in the material landscape and the embodiment of the values of cultural common cognition. It contains this higher level the design concept is the soul of the vitality and vitality of the urban environment. The urban waterfront landscape can be

divided into three parts: water landscape, transitional landscape, and surrounding land landscape [6].

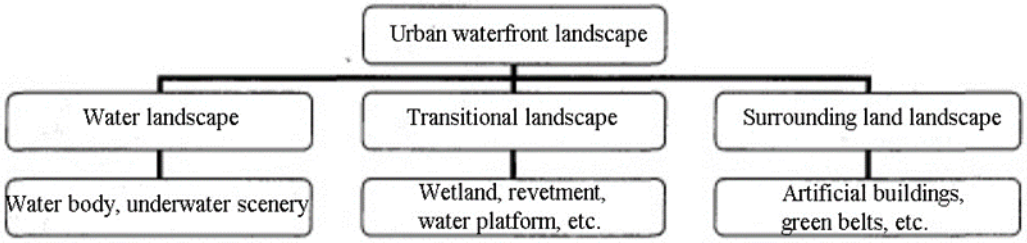

Fig. 3-2 Analysis of landscape composition of urban waterfront

3.4.1 Water landscape

The water landscape is determined according to the basic characteristics of the urban water system. The different types of rivers, lakes, and seas present different landscape features, with their personalities and styles. The water landscape is determined by factors such as the plane scale of the water area, water quality, water ecosystem, regional climate, and human activities on the water surface.

Water landscape is the main component of the waterfront landscape, which determines the character and appearance of the waterfront landscape. At the same time, the cultural and historical origins contained in the water landscape are also the dominant clues in the landscape design, reflecting the urban culture and display the root of future development.

3.4.2 Transitional landscape

The transitional landscape refers to the landscape in the area where the water level fluctuates on the shore, mainly including the wetlands and slope protection on both sides of rivers and lakes, water platforms, and flood control dikes.

The landscape in this area connects water and land and is a transitional area between the two. The landscape in this area is more hydrophilic. It is a high-frequency area for crowd activities and yearning. It is also an area planned as a bright spot in landscape design.

3.4.3 Surrounding land landscape

The surrounding land landscape is mainly determined by the geographical landscape. It is influenced by the city's politics, economy, and culture. It reflects the surrounding natural landscape or city features. It integrates urban architecture, sculptures, waterfront green corridors, and public

activity spaces. Integrated landscape environment.

Different waters, transitional areas and surrounding land landscapes form a colorful urban waterfront landscape, which reflects the style and characteristics of the waterfront and even the overall landscape of the city, or renews and develops on the historical relics of the waterfront. The precious natural heritage of the motherland has gradually formed, such as the West Lake waterfront in Hangzhou. Or it may be born with water, forming a new urban focus, gathering new vitality of the city, and becoming an important tourism resource.

3.5 Water culture and significance of urban waterfront landscape space

3.5.1 Definition of water culture

"The highest good is like water. Water is good for all things without fighting. It is the evil of everyone, so it is more than Tao." In Chinese philosophy, we believe that water is the noblest object, but it also has the lowest status. Water culture is an important part of the entire social culture. The so-called water culture refers to the overall material and spiritual cognition of how to understand water, manage water, use water, care for water, and appreciate water in the historical development of human society. It is the regional spirit born in the process of civilization development.

3.5.2 Regionality of water culture

In the cultural resources of the entire world, whether in the East or the West, the vast and distant waters have produced different water cultural phenomena. The long Nile River gave birth to the splendid ancient Egyptian civilization. The rise and fall of the Euphrates River obviously affected the rise and fall of the Kingdom of Babylon and the vastness of the Mediterranean Sea. Crete became the birthplace of ancient Greek culture. The two rivers flowing through the east, the Yellow River and the Yangtze River, nourish the profound Central Plains culture and the romantic and colorful Chu culture.

As far as China is concerned, five typical water cultures have been formed according to the geographical topography. They are concentrated in the middle reaches of the Yellow River in Shaanxi, Shanxi and Henan. The water culture of the Yellow River is concentrated in the Yangtze River system, the Xiaoxiang culture is concentrated in the upper reaches of Qiantang, and the Wuyue water culture in the middle reaches is concentrated in the Three Gorges of the Yangtze River and the Yangtze River Canal culture and Chuanjiang culture in the Ejiang River basin. In addition to these five main "water cultures", there are also some relatively small ones. Such as the North Canal Culture, Guilin Lijiang Culture, Lingnan Pearl River Culture, Kunming Dianchi Culture, Jinan

Spring Culture, etc.

3.5.3 Water culture is the endogenous context of urban planning

Although the geographical conditions of our cities are different, the construction method of "water culture" is the same, that is, through pollution control and storage, urban rivers and lakes have been transformed. The main performance is to increase the water area, form the function of slowing down runoff, reducing pollution, adjusting the climate and beautifying the city.

The penetration and improvement of "water culture" in modern urban planning and construction has at least five main benefits. One is that ecological water is sufficient, which can become a carrier of household and industrial pollution, forming a cycle of symbiosis and purification of water, organisms and vegetation, and greening and beautifying the city. The second is to expand the water area, increase green vegetation, and build ecological gardens, which will help reduce dust and noise, purify the air, improve the living environment, and improve the quality of life. Third, with the development of today's transportation and communications and the continuous improvement of people's living standards, people are paying more and more attention to the selection and improvement of human settlements. "Ecological city" will become the inevitable destination of sustainable development of the human living environment. It is not only reflected in the relationship between man and nature, the symbiosis between nature and man, the return of man to nature, the proximity to nature, and the integration of nature in the city, but also the creation of ecology. A city that satisfies the needs of human evolution has a rich cultural atmosphere, full of humanistic atmosphere, and has a vibrant urban culture and urban environment image. Fourth, the construction of water environment gardens and the development of "water culture" are conducive to attracting foreign investment, attracting tourists and improving the image of the city. Fifth, with the in-depth development of the surrounding rivers and lakes, the price of land will rise sharply, which will raise a lot of funds for the reconstruction of the city.

3.5.4 Water culture is the ideal support for human settlements

Since ancient times, humans have chosen to live by the water, and civilization has also developed along the river basin, and has continued to rise to new heights by relying on water systems. Many cities depend on water for their livelihoods and prosper because of water. Water has a primitive relationship with cities. On the one hand, the water is the place that all-natural creatures yearn for. The development of land and water and abundant aquatic plants will naturally attract more people. There are more and more people on the other side, and a well-developed water system has brought convenience to transportation, product distribution and business prosperity. Human beings gather

because of water and accumulate a large amount of water-related culture for the city, which has become the representative culture of the city.

The status quo of urban "water culture" largely determines the status quo of the urban environment. Therefore, the use and protection of water resources is also the protection of the environment, and water quality is the embodiment of the quality of the city.

3.5.5 Water culture is the representative of artistic conception of city image

"Artistic conception" is the manifestation of the comprehensive perception of the city. The use of "water culture" in the design of the city's image is not only the principle of planning but also the culture in the "artistic conception". The water system determines the shape of the city to a certain extent, is the source of the formation and development of the city, and also the soul of the city. This Eastern philosophy can be seen in most of China's landscaped cities. For example, in the layout of cities such as Beijing, Hangzhou, Suzhou, and Chengdu, it can be seen that the pursuit of urban artistic conception determines the direction of urban expansion through the trend of mountains, and determines the living area through the distribution of water systems to achieve spatial " Combination of virtual and real.

"Artistic conception" is the emotional resonance that nature gives to the city. In classical Chinese cities, through the treatment of the relationship between mountains and waters and nature, a city with mountains and waters is formed, and there is a close relationship between architecture and natural landscape. Many poets have written stories that have been passed down for thousands of years to express the beauty of the urban landscape. For example, when the poet Li Bai of the Tang Dynasty lived in Chang'an, he wrote: "Going out to see Nanshan, leading infinitely.". Meng Haoran sang Dongting Lake: "The autumn is beautiful and wide, and I want to return to the ship." These are all expressions of the city's artistic conception, and the city's soul under the context of water culture.

3.6 Urban waterfront space landscape elements

3.6.1 Materiality elements

① Natural landscape elements:

Topography and topography: The special topography and topography of the city can usually bring a unique landscape style to the waterfront. The continuous changes and undulations of the topography can enrich the facade landscape. The full use of topography in the design can achieve the effect of enhancing or weakening the landscape. At the same time, it can also use topographical

features to drain. Rainwater falling on the ground will become surface runoff before it seeps into the ground or evaporates to ensure that the ground will not accumulate water and drain water in time. The slope of the terrain determines the speed of surface runoff. And direction.

Waterbody: The water body is the core of the waterfront landscape, and its influence on the waterfront landscape is diverse. Static (relatively static) and dynamic water brings people completely different psychological feelings. The slow current makes people feel peaceful and relaxed; the "rolling Yangtze River eastward" shows the momentum of a large-flow water system. The plane relationship between the water body and the urban layout also determines the uniqueness of the urban landscape.

Animals: Animals are one of the important life elements on the waterfront. The animals in the waterfront are mainly birds, insects, amphibians and aquatic animals. These animals have formed a relatively complete and stable food chain in the long-term ecological tour to ensure the stability of the waterfront ecosystem. When developing the waterfront, it is also necessary to pay attention to biodiversity and reduce the impact on the ecological environment.

Plants: Plants are the main element of the waterfront landscape. Different combinations of plants can form a distinct seasonal change in the waterfront. Plants can not only form a scene independently but also can be used as an atmosphere for the entire waterfront landscape.

②Artificial landscape elements:

Hard paving: Hard paving in the waterfront is mainly used for roads and squares. The form, color, style and material of the paving can directly reflect the main functions and character of the space. The zoning can also be clarified through different paving, and the paving materials should fully consider safety, ecology, sustainability and landscape.

Buildings: Buildings in the waterfront area can be divided into existing buildings and newly built buildings. The existing buildings also include some historical buildings, such as ancient bridges and ancient pavilions. These historical relics with a clear historical style and representing local characteristics have aesthetic value and research value in themselves. Organic updates should be made based on protecting history. New buildings should be constructed on the premise of respecting the style and volume of historical buildings, and at the same time consider the complementarity of their functions to the current space.

Landscape sketches: Although the landscape sketches are small in size, they are a display of spatial vitality and interest. The forms of landscape sketches are diverse, such as Paul Pavilion, sculptures, scenery walls, fountains, etc. The landscape sketches in the waterfront area should be

designed based on the general style and theme so that the sketch style and spatial rhythm in the entire area Fit together.

Ancillary facilities: Ancillary facilities are service facilities that the public needs to be equipped for activities on the waterfront. Such as seats, signs, street lights, public toilets, sports and fitness facilities, etc. When setting up auxiliary facilities, humanity should be taken as the starting point, and public needs should be fully considered.

3.6.2 Non-material elements

The non-material elements are mainly humanistic landscape elements. The history, culture, and customs in or around the waterfront are closely related. It is the manifestation of the spiritual culture in the area, the unique local customs, historical accumulation and spiritual sustenance, and is the endogenous logic followed in the waterfront landscape design.

Reference

[1] Pengyu Li，Xiaodan Li，Yi Li. Flowing History, Flowing Culture: Planning for Lijiang, Hongcun and Suzhou Ancient Town from Human and Celestial Tune [J], Jiangsu Architecture，2010（4）：33-35.

[2] Kallen，Concise Town Landscape Design [M]，China Construction Industry Press，2009

[3] Kevin Bone, Mary Beth Betts, Eugenia Bone. The New York waterfront: Evolution and Building Culture of the port and Harbor [M]. Monacelli,2003:214-215.

[4] Dukui Li，A First Look at German Waterfront Condominium Design [J].Urban Architecture，2009（4）：14-17.

[5] Yaoyuan Lian，Xiaokui Chen. The Case and Experience of Urban River Ecological Restoration in Korea [J]，Water Resources Protection，2010，26（6）：93-98.

[6] Yi Lu. Research on the Theory and Application of Urban Waterfront Landscape Planning and Design [D]. Northeast Forestry University,2007.

[7] Peter singer . All Animal Are Equal. Environmental Ethics: Reading in Theory and Replication , edited by Louis P Pojman .Tones and Bartlett Publisher, Inc 1994.

[8] Kevin Lynch，City Intent [M]，Beijing: Huaxia Press，2001：34-39.

[9] Aldo Rossi，translate by Shijun Huang，Urban Architecture [M]，Beijing: China Construction Industry Press，2006：114-120.

[10]Cairns J Dickin K L.A simple method for the biological assessment of the effects of waste discharges on aquatic bottom-dwelling organism[J].Water pollute. Contr.Fed,1971,43.

[11] Patt H, et al. Naturnaher Wasserbau: Entwicklung und Gestaltung von Fliessge waessern [M](2.Auflage).Heidelberg:SPringer-Verlag,2004.

[12] Wenna Hu. A Preliminary Exploration of the Urban Spatial Form of a Waterfront City on the Banks of a River [D]，Beijing: Tsinghua University，2004:27-29.

[13] Lee Jung A, Lee Yoo Kyoung, Lee Sang Woo, et al. Landscape Resources Evaluation strategy of rural waterfront villages - An application to a rural waterfront village along the Han river. 2011, 17(3):91-101.

[14] Binyi Liu. Urban Waterfront Landscape Planning and Design [M]，Nanjing: Southeast University Press，2006，123-130.

[15] Bryan Lawson. Language of Space [M]，China Construction Industry Press,2003,12.

[16] Kim Yong Hee, Kang Young Jo. A Study on the Micro-Topography Landscape Characteristics and Waterfront Landscape Style of Waterfront in Korean Jingyeong Landscape Painting. 2019, 47(1):26-38.

[17] Batty Michael, Wyatt Ray, Haklay Muki, et al. Review: Fluid City: Transforming Melbourne's Urban Waterfront, GIS, Environmental Modelling and Engineering, Landscape Simulation Modeling: A Spatially Explicit, Dynamic Approach, Profiling Machines: Mapping the Personal Information Economy, Surveillance as Social Sorting: Privacy, Risk and Digital Discrimination, Dialogues in Urban and Regional Planning 1. 2005, 32(2):305-316.

[18] Philip Feifan Xie, Kai Gu. The changing urban morphology: Waterfront redevelopment and event tourism in New Zealand. 2015, 15:105-114.

[19] Weiquan Zhou, History of Classical Chinese Gardens [M], Tsinghua University Press, Beijing,1999,10,407-435.

[20] Ni Shan, Rong Guo, Jun Lu. Open Space Landscape Design [M], Liaoning Science and Technology Press,2002,2.

[21] Masaaki OKADA, Koichi NAKAMA, Yoshio NAKAMURA. A Study on Visual Features of Industrial Waterfront Facilities For Landscape Design. 1995, 12:383-388.

[22] Daisuke NISHIBAYASHI, Masaaki OKADA. Study on Property and Evaluation of Night Landscape in Waterfront. 2005, 21:199-203.

[23] Application of the Planning Factors on Urban Waterfront for Composition of the Landscape Characteristics - With Special Emphasis on the Urban Waterfront Development of the Domestic and Overseas Cases. 2012, 13(6):103-117.

[24] Dejian Kang. Urban Waterfront Landscape Planning and Practice Research [D]. Central South University of Forestry Technology,2016.

[25] Laura Alice Watt. A Negotiated Landscape: The Transformation of San Francisco's Waterfront Since 1950. 2018, 23(1).

[26] Markus Hesse. A negotiated landscape. The transformation of San Francisco’s Waterfront since 1950. 2017, 22(6):784-785.

[27] Xianmin Meng, Ping Sun. The Grand Canal and the Integral Protection of Yangzhou [J], China Ancient City, 2008,S1:64-71.

[28] Jeong-Hun Mok. The Han River Renaissance: Prospects and Tasks for the Improvement of the Waterfront View of The Han River. 2007, 11(2):185-199.

[29] Jessica Miller. A Negotiated Landscape: The Transformation of San Francisco's Waterfront since 1950. 2014, 15(1):118-120.

Chapter 4

RESEARCHING EXAMPLES AND ASPECTS

CHAPTER FOUR: RESEARCHING EXAMPLES AND ASPECTS

4.1 Background and characteristics analysis of three examples

4.1.1 District background analysis(background, environment, atmosphere)

①Section of Hangzhou riverside

District background

This research was launched in Hangzhou, Zhejiang province, PRC (120° 15′ 26′ ′ E,30° 15′ 39′ ′ N)(Fig.1). Zhejiang is one of the most rich province in China which is highly urbanized(beyond 68% in 2018). In one hand, such a social and economic status indicated that people's basic demands were met well and people were looking forward to higher living quality, in another hand, the goal of city development was shifted to creating sustainable, flexible and healthy environment from upgrading infrastructure traditionally in Zhejiang province. Therefore, the ongoing city planning and designing should focus on improving city environment quality and meeting citizen's demands on society and economy. Riverside section waterfront space located in South of Hangzhou, Zhejiang, the south bank of Qiantang river downstream, is the main public space in Binjiang district. There are 392 thousand people dwelling in Binjiang district by 2018.

Fig. 4-1 Sketch map of Hangzhou, Zhejiang province(top),

map of Binjiang district(left bottom, picture source: https://map.baidu.com/),

distribution situation of available land in Binjiang district(right bottom)

Hydrology condition:

There are 5 main rivers total length are 29.31 km which are Xinpu River, Xiyongjiu River, Dongyongjiu River, Xiaoli Mountain Baima Lake Shushui River and Shijia River.

Ecology condition:

The terrain in Binjiang district is flat and it's sandy plain caused by Qiantang River soil warping except several low mountains and hills such as Huilong Mountain, Guan Mountain and Zihong Mountain. In geology it is belong to Qiantang River alluvial plain, terrain is flat, tectonic is simple and there is no danger of large disasters.

Atmosphere condition:

Climate of Binjiang district features subtropical monsoon climate, annual average temperature is

16.27℃, average relative humidity is 6%, mean annual precipitation is 1452.5mm, mean annual sunshine duration is 1899.9h, annual mean evaporation is 1235.3mm, frost-free season is 248 days, perennial prevailing wind direction is southeast wind. Climate is warm and sunshine is adequate, seasons are distinctive and rainfall is abundant, there is no disasters such as freeze injury.

②Section of the Beijing-Hangzhou Grand Canal in Hangzhou

District background:

Hangzhou locates in south wing of Yangtze River delta, the west end of Hangzhou bay, the downstream of Qiantang River, the southernmost point of the Beijing-Hangzhou Grand Canal, the beginning of the Beijing-Hangzhou Grand Canal. It flows through for districts in Hangzhou which are Yuhang district, Gongshu district, Xiacheng district and Jianggan district. Nowadays, section of Hangzhou is spruced up after a complete renovation and as beautiful as painting. There are 25 remains, parks and scenery spots for tourism and attracts large amounts of tourists everyday along river. There are green belt, small parks, footpath along the bank for people entering public green belt freely, waking, having break, enjoying scenery and canal culture, developed a harmonic relationship between people and nature.

Recently, there is a great achievement in comprehensive protection for Hangzhou Canal. Some functions used to be disappeared are improved completely in Hangzhou section of canal, a river which contains more age characteristics, Hangzhou specialty and canal feature will be presented to people, and becomes the new landmark which shows past, now and future of Hangzhou.

Hydrology condition:

The total length of Beijing-Hangzhou Grand Canal is 1794km. It is the second golden waterway which rank only second to Yangtze River. Beijing-Hangzhou Grand Canal is the longest and the earliest built artificial waterway, which is as 9 times long as Suez Canal(190km) and 22 times long as Panama Canal(81.3km). The Beijing-Hangzhou Grand Canal is longest in length, largest in engineering and oldest in history and it left immortal trace and donated greatly in China’s economy development. It is still working as traffic artery today silently.

Walking from Gongchen Bridge in Gongshu district to Chengdong Bridge in Jiangqian district along the canal is like walking in a ecological corridor. Ancient remains such as Jiangdong ancient town, dwellings along canal and arch bridge built in Ming Dynasty can be found like peals along both banks. Gongshu district shows plain charm of canal, Xiacheng district shows blooming scenery of canal, and canal section in Jiangqian district represent for canal in the future running and join into Qiantang River, which is in a grand style.

Ecological condition:

Hangzhou emphasized protection on Beijing-Hangzhou Grand Canal in these years and put forward a goal named “Constructing Eastern Seine”. In order to change the appearance of “dirty, chaotic, bad” of Hangzhou section of canal , Hangzhou renovated canal several times via engineering such as communication river, dredging canal, regulation river and building bridge, to implement six engineering which are water pollution controlling, cultural tourism, greenery landscape, perfecting road net, constructing dwellings and land consolidation, so that making waterfront district of canal becoming an organic integrity. It helps canal become a green ecological and tourism scenery belt which water is clear, bank is green and scenery is beautiful by renovation.

Fig. 4-2 Waterfront space of Beijing-Hangzhou Grand Canal

Atmosphere condition:

Hangzhou is located in the subtropical monsoon region, featuring the subtropical monsoon climate. There is distinct four seasons and abundant rainfall. The annual average temperature is 17.8℃, the average relative humidity is 70.3%, the annual precipitation is 1454 mm, and the annual sunshine hours are 1765 hours. Summer is hot and humid so that Hangzhou is one of the four new furnace. On the contrary, winter in Hangzhou is cold and dry. In spring and autumn there is pleasant weather and both are the golden seasons for sightseeing.

③Shaoxing section of the Grand Canal

District background:

With a history of over 2,500 years, Shaoxing is one of the first batch of national historical and cultural cities, UN-Habitat Award city, China's Excellent tourist city, National forest City, the most dynamic city of China's private economy, as well as the famous hometown of water, bridge, wine, calligraphy and famous people. Shaoxing is known as "the land of cultural relics and the land of fish and rice". Shaoxing ancient canal has a long history and rich relics. It is the core area and main body of eastern Zhejiang ancient Canal. Among this section of the canal, there are four sections

listed as world heritage, namely, the Shaoxing section of the Grand Canal, the Eight Character Bridge, the Eight Character Bridge historical block and the Ancient Towpath. These sections are regarded as the most precious shining point and the most cultural value of the Shaoxing section of the Grand Canal. The Shaoxing section of the Grand Canal is the core part of the heritage, which is the remains of the shipping waterway and related facilities in the past dynasties, followed by the rich cultural relics, historical sites and landscapes throughout the canal, including cities, villages and towns, as well as some intangible heritages that are still alive, such as languages and customs.

The ancient Canal in Shaoxing is part of the Hangyong Canal (also known as the Eastern Zhejiang Canal, which runs from Hangzhou to Ningbo at the mouth of the Yongjiang River) and is an extension of the Beijing-Hangzhou Canal. The Hangyong Canal is 239 kilometers long and was built in the Spring and Autumn Period. Shaoxing canal is 101.4 kilometers long. Shaoxing Canal Park represents the essence of history and culture, with a total length of 4.5 kilometers. By the side of highway G104, six scenic spots are distributed: chronicle of the canal, customs along the river, remnants of the ancient bridge, windsurfing, the Road of Tang poetry, and the ancient wooden crossing.

Hydrology conditions:

Shaoxing is famous for its densely covered rivers and numerous lakes. Restricted by the direction of the mountains and affected by the subtropical monsoon climate, the river is generally characterized by abundant flow, seasonal changes in water level, two flood seasons in a year, rich upstream hydraulic resources, and the lower reaches are mostly supported by the tidal crest. There are mainly Cao 'e River, Puyang River and Jianhu river systems flowing into Qiantang River. The eastern Zhejiang Canal traverses the north from east to west, communicates with the south-north rivers, and interweaves into the northern plain river network system with a high density of rivers. In addition, part of the River in Shangyu belongs to the Yongjiang river system, and a small part of Zhuji belongs to the Huyuan River, which flows directly into the Fuchun River through Fuyang[1]

Ecology condition：

Shaoxing is located in the transition zone of the three geomorphic units of western Zhejiang mountain, eastern Zhejiang mountain and north Zhejiang plain. The terrain is high in the south and low in the north, forming the geomorphic features of surrounded by mountains, contained in basins and concentrated in plains. The topographic framework is shaped as "mountain". Geomorphic features can be summarized as "four mountains, three basins, two rivers and one plain", while in terms of area distribution, it is manifested as "six mountains, one river and three fields", and the whole terrain slopes down from southwest to northeast.

Shaoxing Canal Park water conservancy scenic area is built in the process of renovating the ancient canal in eastern Zhejiang province, which is a comprehensive garden integrating history, culture, ecology and leisure. The construction of the scenic spot improves the city's flood control ability and adds an ecological corridor full of water town culture along the way. The Shaoxing section of the Grand Canal has been preserved because of its continuous use, but there are also some problems. For example, some sections of the canal channel were widened to the two sides, so that the original embankment of the canal was destroyed, and some valuable sections, nodes, DAMS and other water conservancy projects were constructively destroyed. However, more and more residential developments along the canal, especially the construction of multi-storied buildings, should arouse people's attention to avoid reducing the authenticity of the canal's historical environment. Of course, water environmental pollution is still an urgent problem facing the canal heritage conservation and management.

Atmosphere condition:

Shaoxing is located in the subtropical monsoon climate zone, with a significant monsoon and four distinct seasons. The climate is mild, moist and rainy. However, due to its location in mid-latitude, complex terrain, distinct microclimate differences and frequent disastrous weather.

4.1.2 District characteristics analysis(economy, culture, history, function)

①Section of Hangzhou waterfront space

Economy:

Binjiang section of Hangzhou, where Binjiang section of waterfront landscape space is located, there is no primary industry, but rich secondary industry, including the Internet of Things, Internet industry, ecological creative industry and other high-tech industries, strategic emerging industries are increasing, and the industrial structure is continuously optimized.

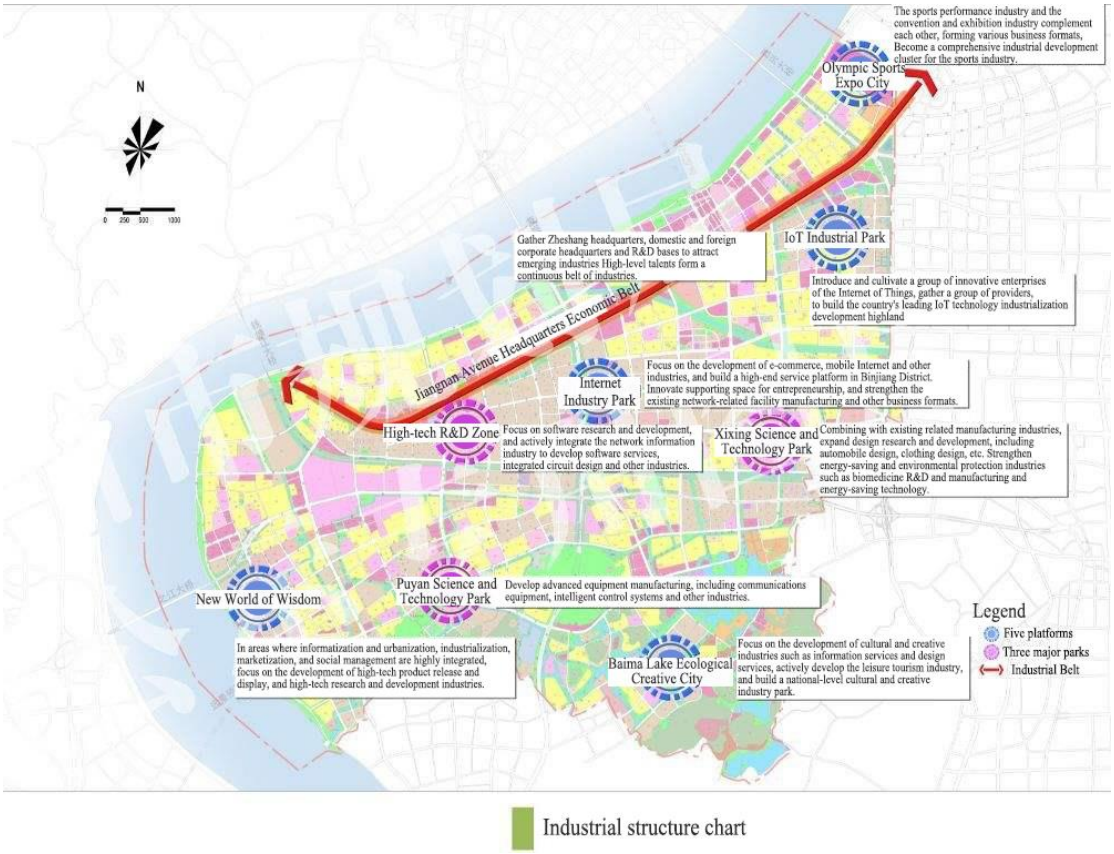

Fig. 4-3 Industrial structure chart of Binjiang District

(sourse: http://k.sina.com.cn/article_6535826491_18590cc3b00100d7so.html)

Culture:

Folk entertainment: local operas popular in Jiangsu, Zhejiang and Shanghai: burlesque, also known as one-man opera. It originated from the local folk art "little hot twilight" which prevailed in Hangzhou in the 1920s. Over the past decades, talents have been cultivated, opera paths have been widened, and comedy, music and dance have been organically integrated, which has not only been welcomed by new and old audiences in Hangzhou, but also made the southern burlesque break through the language restrictions and enter the northern region.

Local cuisine: With a long history, Hangzhou cuisine, together with dishes from Ningbo and Shaoxing, constitutes Zhejiang cuisine, becoming one of the eight major cuisines in China. And it is the representative dish of Zhejiang cuisine. Hangzhou cuisine is known as "Fan Zong Cuisine". With its unique clear and elegant atmosphere, Hangzhou Cuisine has become one of the eight new cuisines and is popular all over the country with its unique "taste".

History:

In history Binjiang district has been an important ferry crossing of the Qiantang River north and south. Puyan was the place where Gou Jian, king of Yue in ancient times, ordered his troops to enter Wu. In the northern Song Dynasty, taiping Xingguo three years (978), changxing township was set up here, the Yuan Dynasty renamed Shidu. The Qing Dynasty began to call Puyan, Guangxu years to change the "weir" for "along", meaning for the landscape around, the peaks between the peaks of the mountains, the beautiful scenery for the southeast resort. It can be seen that Binjiang district has attracted people to live here with its unique waterfront landscape since ancient times, and has been the origin of culture since water.

There are two waterfront ancient towns in the region - Xixing ancient town and changhe ancient town. Among them, Xixing ancient town is a historic protection block and an important part of Hangzhou as the name of Chinese history and culture. The western end of Xixing ancient town is connected with the source of eastern Zhejiang ancient Canal, which is the origin place of eastern Zhejiang ancient Canal. Xixing is an important commercial town. Due to its developed water system and land location, it is a hub for freight transportation from north to south.

Changhe ancient town is an ancient town for thousands of years. The ancient temples, historical dwellings and traditional streets around Guanshan Temple are the symbol of the long river history. The typical architecture of jiangnan water town in the ancient town was once as famous as Xitang, Nanxun, Wuzhen and other ancient towns.

Fig. 4-4. Xixing ancient town(left), Changhe ancient town(right)

Functions:

As the main administrative region of Hangzhou, Binjiang District bears the daily life of residents and embodies the development of emerging industries. It is an important space for urban life. The landscape planning of the waterfront should be based on the daily life of residents and be devoted to improving the vitality of urban space.

②Hangzhou section of canal

Economy:

The Beijing-Hangzhou Grand Canal has a direct impact on the development of cities on both sides of the Yangtze River. Looking at the map of China, the Beijing-Hangzhou Grand Canal runs through two of China's most dynamic economic belts (coastal economic belt and Yangtze Economic Belt) and economic circle (Yangtze River Delta economic Circle and Bohai Bay Economic circle). It was the north-south connection of the Beijing-Hangzhou Grand Canal that gave birth and prosperity to cities of all sizes along the coast. Hangzhou is at the southernmost point of the Grand Canal. It is the starting and ending point of the Canal. Hangzhou was born and built on the river. The Grand Canal is the river of Hangzhou's growth and prosperity.

Culture:

The millennium Canal has also formed Hangzhou's unique charm of "canal water town everywhere river, east, west, North and South step by step bridge"; The teahouse folk art, various operas and "happy songs, fishing and singing" on the water of the canal, gathered together by generations on both sides of the canal, were deposited in the north of Hangzhou like sand. Since the Ming and Qing Dynasties, the temple fairs along the Canal have been at their peak. The Dragon Boat Festival and the canal Lantern Festival are all folk events in Hangzhou.

Canal water not only carries the ships from north to south, but also nurtures and moistens the canal children and canal cities along the coast. The buildings along the canal, such as guild hall, river port, wharf, bridge, ship lock and Caoyun yamen, were built for use in actual production. Canal side also has a lot of folk custom folk custom to reveal pragmatic soul. For example, in Huaian, Jiangsu, the canal fishermen's custom of "bow", "feast before the flood", "full load meeting" and so on. These customs are the harvest of praying for actual production, which directly and truly reflect the working people's desire for a real harvest. The canal production process also created a lot of production related art, such as the Grand Canal. The song of the river works is sung by carrying the river, carrying the earth, building embankments, underpiling and ramming. On the one hand, these songs can inspire the spirit; on the other hand, they can organize and direct collective labor, such as the Song of Carrying Earth in Shandong province. The boat trackers on the canal have the boat trackers, the boat trackers, the rice trackers and so on. Boatmen have boatmen's Numbers, among which there are a lot of categories, starting out of the boat, push boat number, anchor number, anchor number, pull peng number, punting number, etc., driving paddle number, towing fiber number, pull horn number, sail number, stop the ship under the anchor number, pull rope number, etc. These were both formed in actual canal production and actually contributed to it.

History：

The Beijing-Hangzhou Grand Canal began to be dug in 486 BC, more than 2,500 years ago. An important river course dug by Emperor Qinshihuang in Jiaxing also laid the foundation for the canal to reach the south of the Yangtze River. According to the Yueju Book, the First Emperor of The Qin Dynasty in Jiaxing "from Zhiling Road to Qiantang Yue land to Zhejiang", the canal and its culture were derived from this. The Grand Canal was dug in the Spring and Autumn Period, completed in the Sui Dynasty, flourished in the Tang and Song Dynasties, straightened out in the Ming and Qing dynasties. In the long years, through three major repair process. The last construction was called the Grand Canal. It is a great project created by the laboring people in ancient China and a symbol of China's cultural status. With its unique communication function, the Beijing-Hangzhou Grand Canal connects the political center and economic center of the country, and connects the production areas of different river basins. Based on it, the rulers of the feudal dynasty established the grain transport system, which lasted for thousands of years, to transport materials to the capital, and maintained the life of the dynasty.

Function:

In the history of water resources, China's man-made grand Canal is second to none. It runs through five major east-west rivers: Haihe, Yellow, Huai, Yangtze and Qiantang. The great hydraulic feat of the Grand Canal is that it crosses these rivers five times by means of locks. At the same time, when the Grand Canal meets the lake, a separate river is opened to avoid the waves in the lake. There is no need to take risks, the pursuit of peace is the essence of canal culture.

The Grand Canal was dug for imperial freight. The grain transport was the most important function of the ancient Canal. Although it existed in the Qin Dynasty, jiangnan became the main source of grain grain after the Kaiyuan Of the Tang Dynasty. The folk commercial transport and passenger transport also grew because of the trend, and the famous brands of porcelain, tea, paper, textiles and other important goods were also widely expanded. Tang dynasty Li Jifu wrote: "the public transport tank, private business, ZhouLu successively". As a result, there was a division of labor among the ships that were transported on the canal. By the Ming Dynasty, the ancient canal had set up 11 passes, including Yangzhou, Shangxinhe, Hushu and Jiujiang. Among them, Daguan Bridge in Hangzhou was one of the seven passes in China. In 1686, tens of thousands of liang of silver were collected for tax collection. During the Reign of Daoguang in the Qing Dynasty, the pass was once extended to 24 places, showing the prosperity of commerce and transportation above the canal.

The location in the picture is Gongchen Bridge, opposite the bridge is the ancient town, handicraft

exhibition hall, Zhang Daxian Temple, Temple of wealth, Grand Canal Hospital of Chinese Medicine, Chinese Museum of Knives, Scissors and Swords, Chinese Embassy of Arts and Crafts, etc. All these can help visitors to have a deeper understanding of Zhejiang and Hangzhou. This is one of several sculptures on both sides of the canal to represent local customs and historical allusions.

③Shaoxing ancient canal

Economy:

The primary, secondary and tertiary industries in Shaoxing have been developing steadily. At the same time, Shaoxing has put forward the strategic target of "revitalizing the water city and rebuilding the Chen Ye" for the ancient canal. We will focus on the development of "two rivers, ten lakes and one city", comprehensively improve the overall water environment quality of the water system, water surface, water quality and Banks, and comprehensively raise the level of industrial development. By 2020, a modern industrial system based on modern agriculture and led by strategic emerging industries, supported by traditional competitive industries and based on modern agriculture will be established. The ecological belt functions of the Cao 'e River and Puyang River basins are effectively reflected, and the ecological and landscape functions of the ten lakes are brought into full play. It has initially formed a core urban water city, a livable, business-friendly and tour-friendly center with "clear water, green shore, integrated city water and people water". This strategy closely combines water control with industrial transformation and urban upgrading, thus achieving a very clear goal of optimizing the pattern of water city and reshaping its image.

Culture:

Shaoxing ancient canal along the beautiful scenery, attracted a succession of famous people. Like in the Tang Dynasty, the ruins of many poets in Yue State, they came by boat from the canal, all the way to visit poetry, formed a famous "Tang poetry road". Shaoxing's most distinctive folk customs are mostly formed along the ancient canal. Many traditional folk activities in Shaoxing, such as the Dragon Boat Race at the Dragon Boat Festival, the Festival of spirits, and the Festival of welcoming the Gods, have been held for thousands of years, from which the cultural origin of this ancient canal can be explored.

She Opera is a traditional folk entertainment custom popular in Shaoxing. It was performed in spring and autumn to offer sacrifices to gods in both urban and rural areas of Shaoxing in order to reward gods and pray for their blessings. She Opera originated from the spring and autumn custom of sacrificing to gods (land gods) in rural areas. At first, the spring club prayed for a good harvest, and the autumn club celebrated a good harvest. Later, it developed to pray for the god with theatrical performances, and then it became a folk cultural entertainment activity. As early as in the Southern

Song Dynasty, the custom of social opera in Shaoxing was still popular in the late Qing Dynasty[2]. Black boat, black felt hat; She Opera, Shaoxing Opera and Yue Opera; Water town, bridge town, wine town, calligraphy town, these are the ancient city of Shaoxing cultural elements.

History：

The ancient Canal in Shaoxing runs through the history of Shaoxing and has a profound influence on the economic and social development of Shaoxing for thousands of years. On June 22, 2014, The Grand Canal of China was successfully included in the World Cultural Heritage List, becoming the 46th World Heritage Site in China. (The Grand Canal of China consists of the Grand Canal of Sui and Tang Dynasties, the Grand Canal of Beijing and Hangzhou, and the Canal of eastern Zhejiang province.) The Shaoxing section of the Eastern Zhejiang Canal includes four projects: The Shaoxing section of the river body, the Bazi Bridge, the Bazi Bridge historical block and the ancient fiber road, which are the most precious shining point and the place with the most cultural value. Someone said "a canal history, half the history of Shaoxing", is reasonable, in the old road traffic is not convenient, as "the hometown of textile" and "Shaoxing rice wine hometown", by convenient waterway, and the canal is an ancient water "highway", deduce how many "because of the canal was born and prosperity", because of the canal's wonderful stories.

The ancient towpath is the most essential part of the Eastern Zhejiang Canal

Keqiao Ancient fiber Road world cultural heritage is a miracle in the history of water conservancy construction in China, with a long history, unique shape and structure, which is rarely seen in China. From west to east along the Eastern Zhejiang canal, starting from Qian Qingban Bridge, to Keqiao Street Shangxie Bridge, a total length of 7.5 kilometers, across the whole area of Keqiao jiangnan ancient town. It is the most essential part of the Eastern Zhejiang Canal.

The ancient fiber road, also known as Guantang and Guantang Road, was a channel for ancient people to travel on the back of boats and avoid wind and waves gently. It was also an important auxiliary facility for canal navigation. It has a history of more than 1000 years, the history from the Western Jin Dynasty xixing canal was dug into the original form, the Tang Yuan and ten years (815 years) had large-scale dredging, the Ming Hongzhi years instead of stone, to form the existing scale. Countless laboring people with slender ropes on their shoulders used to plodding along the towpath, making contributions to the development of Shaoxing's economy Grand Canal (Shaoxing Section), Shaoxing Cultural, Radio, Film and Television Tourism Bureau portal website, 2020]]. "Bai Yu Changdi Road, Wu Peng small painting boat", Qing Dynasty Qi Zhaonan once made a poem to describe the scenery of the ancient towing road. With the development of the transportation industry, the vessels on the canal have changed from being driven by human power to being driven by

machinery. The function of the ancient fiber road has evolved into sightseeing, sightseeing and appreciating the scenery of the water town.

Function:

The ancient Canal in Shaoxing dates back more than 2,500 years. At that time, the eastern part of The yue capital was an important military base and grain producing area. Goujian, the king of Yue, built the shanyin channel for material transportation, especially for raising war preparation materials. The ruins of the ancient canal from the east of Shaoxing's main city to the East pass of Shangyu still exist today, which made the State of Yue achieve the great achievement of the overlord of the Spring and Autumn Period.

Then Ma Zhen, the taiji governor of the Eastern Han Dynasty, built jianhu, which communicated the aquatic connection between the county and cao 'e River. In the western Jin Dynasty, He Xun presided over the construction of the Xixing Canal, which connected the county city with the Qiantang River from then on. This also facilitated the later south crossing of the Jin Dynasty and the first large-scale southbound migration of the Han people in the history of Our country. In the southern Song Dynasty, the Eastern Zhejiang Canal became the lifeline of the southern Song dynasty and entered its heyday.

This ancient "aquatic highway" also led Shaoxing's economy and culture to fly wing to wing. The canal connected the Shaoxing water network, greatly reduced the flood disaster, made irrigation smooth, and made shipping convenient to the outside world. It turned a once "wild place" into a famous "land of fish and rice" and an important commercial town.

4.2 Research field observation analysis

4.2.1 Activity characteristics of the observed population

①Population diversity

In sociological studies, populations are usually classified by gender differences, age stage, income level, and education level.

When differentiated by gender, studies have shown that men and women have different needs for their living environments. Men are more likely to live in places with more recreational amenities. Women are more likely to live near a lifestyle and shopping complex that is easily accessible and includes recreational facilities such as fitness and beauty. Due to the delicate nature of women's personalities, women are generally more demanding of their environments. Therefore, to some

extent, the amount of female activity in the place can also verify the rationality of the space design.

When differentiated by age groups, the same space needs to serve multiple age groups and meet the needs of multiple people. The space should be a place for children to play, for young people to shop, relax, and meet, or for older people to chat, sunbathe, work out, and meet. At the same time, the space should also provide an appropriate design based on age characteristics. (Refer to this article 2.2.4 Characteristics of Activity Behavior of Different Age Groups)

When differentiated by education level, the level of education determines the level of perception of space to a certain extent. While satisfying spatial behaviors, people with higher education levels are more likely to desire spiritual enjoyment in space, such as the cultural atmosphere and hidden spiritual concepts. People with a relatively low level of education may be more eager to get the satisfaction of activities and behaviors in the space, and their requirements for the environment are mainly reflected in the behavioral level.

When differentiated by income level, Maslow's Hierarchy of Needs validates that the environment is judged differently due to differences in income. (Refer to this article 2.1.6 study of Maslow's Hierarchy of Needs) People with higher incomes have higher demands on their behavior, living and working environments. They are looking for a quality life and a refined, artistic environment. Low-income people's focus is still on subsistence living, so their requirements for the environment are relatively low and their tolerance for the environment is generally high.

With regard to the diversity of people in a spatial environment, Wei Hua[4] proposed the concept of "communication space". He believes that urban public space should provide space for people of different income levels, different ages, and different genders to accommodate each other as much as possible, such as public green space, plazas, coffee shops, etc. In this way, social coldness, social isolation, and social differences can be avoided, and a rich and colorful urban public space can be created.

②Density of Crowd Activity

Space crowd density is the prerequisite and judgment basis for shaping the vitality of space [4]. A reasonable population density should be proportional to the number of people. Too high density of space crowd activities will lead to crowded space and affect normal use. But if the space density is too low, the space will be desolate and no one cares about it. The impact of high-density space is two-way, with both positive and negative sides. In a high-density environment, too many people compete for resources, which can stimulate the germination of hostile behavior. The positive side is that people always have the instinct to "join in the fun", they like to observe others and want others to pay attention to themselves. At the same time, the high-density environment will also induce

many public activities. People will also be willing to go to a particular space for a particular reason, and the density of the space will increase, and so will its attractiveness. A typical example is the square dance that can be seen everywhere in parks and squares.

The design of the space also has a significant impact on the generation of crowd density. The right landscape will be an inducement for people to enter the space, thus attracting people to the space and making it participatory.

The design of Woolwich Squares in England was based on the concept of embodying the essence of Woolwich, whether historical or natural, to create a unique space where people can enjoy a day out. The design utilizes pedestrian flow studies to identify key routes through the city center to create a unique public space that enhances the pedestrian experience and meets their needs.

③Crowd activity content

The activities of people in the space can be divided into walking and vehicular traffic according to the activity behavior. Cultural activities are also included.

Walking Activities:

The most basic form of movement is walking. During walking, people can perceive space in all its dimensions and form a basic impression of the city. At the same time, walking is not only a form of behavior, but also a means to stimulate spatial diversity. People will take a break on the way to walk, and open spaces and commercial spaces will be formed, which are all derived from walking. In recent years, urban walking index has become a hot topic of research in China and abroad. Long Ying, a Chinese scholar, optimized the calculation method of walking index and measured the street walking index of 287 Chinese cities using the "large-scale paradigm". He found that "intersection density" and "functional mix" are important influencing factors of the walkability of streets[4].

Vehicular activity:

Vehicular traffic pays less attention to the quality and quantity of the environment. First of all, because of the coherent nature of automobile driving, little attention is paid to the surrounding spatial environment while driving. Nearly all oncoming traffic is purely passing, and only after stopping can people interact with the space. Car traffic is more concerned with getting to the destination than with appreciating the spatial environment of the road.

Cultural Activities:

The spatial vibrancy of cities is shaped by the flow of people. Special festivals or cultural events can stimulate an increase in crowds, encourage people to participate, use and stay in them, and

contribute to spatial dynamism. It can be observed that among all cultural activities, traditional festivals have the strongest relationship with urban spatial characteristics and crowd density, because they are the most national and local cultural activities. There are many traditional cultural activities in China, such as the "Dragon Dance" in Chinese Spring Festival and the "Lantern Festival" in Lantern Festival. In the process of passing down traditional culture, it is gradually adjusted to the changes of the times.

In ancient China, traditional festivals were the main focus of urban activities. For example, the annual Spring Festival ritual in Beijing began in the Tang Dynasty and was formalized in the Ming Dynasty. On the day before the first day of spring, local officials and citizens would collectively come to the "Spring Festival" five miles outside Dongzhimen, dressed in red clothes and wearing colored flowers. In this particular open space, people would ride horses, sedan chairs, make ritual sacrifices, and whip cows to express their desire to welcome spring and promote farming. In addition to the rituals of welcoming spring, festivals held by Beijing citizens in the Ming dynasty that were combined with specific spaces included the lantern fair of the Lantern Festival, and the Bon Festival of the Zhong Yuan Festival etc. The full interaction between the public and urban space has led to the strengthening and development of these places to varying degrees, thus becoming an important component of the city's spatial characteristics.

In addition, tourism activities based on regional cultural characteristics also bring great vitality to urban space. For example, the Kite Festival in Weifang, the Dragon Boat Festival in Yueyang, the Snow Festival in Xuexiang, etc. These activities make use of specific regional spaces and characteristics to launch special activities and products, which are greatly beneficial to the city. It adds to the vitality of the city.

④Crowd Activity Time

People choose spaces based on the time of day. The climates in the north and south are quite different, so the emphasis of space design is different. The difference in climate between the four seasons also has an impact on people's activities. In winter, when the weather is cold, people are in a hurry to get to their destination and rarely stay on the street. In spring, on the other hand, people walk slowly and at a leisurely pace, stopping and sitting to experience urban spaces.

In terms of lifestyle, people travel intensively at certain times, such as on holidays. In daily life, this is usually the time after work and after dinner. At this time, the time of urban life intersects with the time of people, and the use of space increases dramatically.

At the same time, people also pay attention to the creation of spaces for the nighttime economy. Modern culture and post-life styles offer another possibility for urban spaces with nightlife. The

busy work life during the day also induces the option of leisure life at night. It can be said that a timely, applicable, comprehensive and diversified urban space is the ideal carrier of today's urban space characteristics.

4.2.2 Spatial demand characteristics of the observed population

Space demand characteristics are the main basis for judging whether space is reasonable. The indicators in the space are the main considerations when building. In this paper, we mainly discuss five aspects: publicness, interaction, accessibility, safety, and service facilities.

①Publicness

As an urban waterfront space for all, the public nature of the space is inevitable. Waterfront public space is a city's living room, a space for daily life and activities to take place, forming an image of the city that evokes emotional connection and resonance. Therefore, it is necessary to establish the correspondence between urban life and the spatial environment, and propose a series of spatial patterns that can be adapted to human activities. Different people have different requirements for the content of the spaces they serve. Thus, it is necessary to meet the requirements of diverse uses, such as sports, entertainment, leisure and other different activities.However, there are still some urban spaces that limit the public nature. One obvious form of this is the charging of entrance fees in public spaces. In parks and squares, this phenomenon is less common. It is more often seen in public scenic areas where entrance fees are charged. According to a survey took place in 2011, in the year before the entrance fee was abolished at Nanjing's Sun Yat-sen Mausoleum, the number of visitors was only one-third of what it is today. So we can see that limiting the public places places a great limit on the perception of urban space. So we can see that the restriction of the public has brought great limitations to the perception of urban space.

Another form is to break the "secrecy" of the site. Some urban spaces have narrow or hidden entrances, which are not conducive to crowd entry and activity. When designing urban spaces, we should break this disadvantage and connect urban spaces with the external environment. This will not only improve the public space system of the city, but also stimulate the city's vitality.

For example, the open space design on the west bank of the Huangpu River in Shanghai has a project vision of "Hongguan Pujiang". It uses garden-style riverside green spaces to stitch together the various plots of the base, reshaping its unique identity as a public green space in history, and releasing the riverside potential of the North Bund of Hongkou. While linking the various waterfront areas, it also connects the ongoing urban renewal projects in Hongkou District to the riverside and activates key areas through public projects. A key measure is the planning and setting of three active

routes to form a coherent riverside space, opening up the previously cut-off area for people to walk, cycle or jog along the 2.5-kilometer-long Huangpu River. The concept of the "Flowing Light Trail" is also proposed in the green hinterland, which is a luminous, green trail that connects the hotels in the North Bund area and offers visitors a panoramic view of the city and the waterfront. The waterfront area focuses on setting up a wealth of activity venue functions, and a series of green waterfront spaces are arranged for various cultural leisure and entertainment activities throughout the year.

②Interaction

The public nature of urban waterfront spaces encourages people to enter the space, which in turn leads to creative and participatory activities. The public's perception of urban space is based on the interaction of experience after experience.

Some designers create a sense of identity with a place by involving people in the activities in the place, such as the design of the Universal Center Plaza in Wudaokou, Beijing. Zhang Tang Landscape has always advocated the construction of participatory landscape facilities to motivate urban residents to use these facilities, thus improving the utilization of landscape facilities and making the landscape better serve the public. The U-Center Plaza landscape renovation in Wudaokou is a good implementation of this concept. A simple row of dry fountains, a row of trees, and a few rows of benches. At the end, a set of fountains and trees are in a disk that can be rotated. The rotation lasts fifty minutes, and when the group of fountains and trees in the disc return to their original positions, the water begins to gush. The spray will last for ten minutes. The simple version of the master plan contains many mechanisms and facilities underneath, not only enough wooden tables and chairs for people to rest and stop, but also to satisfy the function of the square to gather traffic. The spatial design incorporates a measure of time, creating a ritualistic effect.

③Accessibility

Accessibility can also be understood as spatial accessibility. Spatial accessibility is essentially the degree to which we can move freely between two spaces in a city. It is an important determinant of the vitality of urban space. Spatial accessibility is a prerequisite for people to interact with space. The more accessible a space is, the more frequently it is used, and the more it is recognized by the public. If you have to transfer to multiple modes of transportation or take a private car to reach a space, the recognition of the space will be compromised.

Baltimore's Inner Harbor is a classic example of waterfront redevelopment, and has been called the "granddaddy of urban entertainment" for its mix of diverse functions and rhythmic engineered projects, as well as its rational distribution of businesses to achieve an integrated balance of

popularity and profitability. The traffic organization emphasizes the separation of pedestrian and vehicular traffic, the optimization of the pedestrian environment, the relocation of transit traffic and the priority of public transportation.In the Baltimore renovation process, special emphasis was placed on strengthening pedestrian connections between the city's hinterland and the waterfront, as well as on strengthening the city's activity and visual connections to the waterfront. It also ensures that the waterfront is large enough to accommodate civic activities.

④Safety

Safety is a fundamental requirement for urban spaces. People will not come back to a space if they feel unsafe or worried about moving around in it. Women, in particular, have a more nuanced perception of space and are more sensitive to the potential insecurities that may exist in a space. Once this perception is created, then people will not come back to the space, let alone shape the character of the urban space.

Jacobs proposes another idea, the "street eye": public safety in the city is not maintained primarily by the police, but by a complex, unconscious code of self-regulation and behavior. They exist in and are reinforced by people themselves. She further pointed out that the incidence of crime is closely related to the number of people living in the house, and that vibrant places are often difficult to cause crime[7]. Many of these practices can be seen in traditional Chinese dwellings. The spatial scale or form brings a suggestion of public or private, which in turn influences people's activities and behaviors. A narrow alley may be intimate to the original inhabitants, but it may be oppressive to a stranger arriving for the first time. Thus, the perceived difference in space enhances the safety of the space.

⑤Service Facilities

An important aspect of the vibrancy of urban space is the richness of the mix of businesses. In urban activities, people prefer places with diverse amenities such as markets, coffee shops, bars, hotels, small offices and stores. These small businesses add excitement to the urban space and can be improvised to stimulate people's interest in the facility and interaction with the space. As more people participate in the space, more people are attracted to it. As a result, the space exudes a constant flow of energy.

Sundance Square - Heart of Fort Worth, a popular and heavily used plaza in downtown Fort Worth. With a series of dynamic and interactive spaces, it transforms what was once a surface parking lot separated by two sides into an urban living room. The flexible design and diverse uses promote change and development in the urban core. Three hundred movable seats, fixed benches, and a seating wall allow the venue to be adapted for a variety of needs, such as festivals, concerts, and

community events. Fun interactive fountains and huge umbrellas give the plaza a lasting vibrancy, making it a true community event venue[8].

4.3 Research questionnaire

4.3.1 Questionnaire content design

We analyzed the waterfront spaces from the spatial perspective and the behavioral perspective respectively. Based on this analysis, we developed a research questionnaire and planned to put it into three different types of waterfront spaces: the Hangzhou Canal section, the Hangzhou Binjiang section, and the Shaoxing Ancient Canal.

The questionnaire was further designed to understand the social performance of urban waterfront space by understanding people's attitudes and preference. Considering the complex functions of the case study area, the questionnaire was carefully designed. There are five sections in this questionnaire.

The first and second sections aim to collect the basic information of respondents and acquire their representative activity patterns in this case study area.

Moreover, the third section is designed to investigate the quality of the urban waterfront space. These components in the urban waterfront space were divided into five parts including the landscape, public service, main facilities, supporting facilities and road functions. In each part, concerns are relevant to various aspects such as the layout, quantity, safety and type. Also, each question was five-point based, where 1 represents poor, 2 fair, 3 average, 4 good and 5 excellent.

Afterwards, the fourth section concerns the overall quality of the urban waterfront space. It consists of questions such as transport connectivity with the city, linkage with city characteristics, user's quality and cultivation, space personality and the quality of green belt in isolating freeway. Likewise, each question was five-point based like above.

The fifth section solicits respondents' opinions on the renovation of the case study area. The questions are relevant to the increase in indoor leisure space, the increase in theme exhibition or shows, the increase in E-vehicle and the increase in large business services. The questions are five-point based, where 1 represents strongly disagree, 2 disagree, 3 average, 4 agree and 5 strongly agree. The option of 1—strongly disagree—indicates the respondents are satisfied with the current settings of the urban waterfront space, while the option of 5— strongly agree—indicates respondents are not satisfied with the current settings.

The following are the contents of the research questionnaire:

Questionnaire on Landscape Spatial Behavior of Urban Waterfront

Hello, I am an urban planning and design worker. You can complete this public opinion questionnaire on the satisfaction of the riverside pedestrian space by choosing the answer or directly expressing your opinion. I apologize for taking your precious time, and thank you very much for your cooperation with this survey. Perhaps your opinions will be of important reference value for beautifying our urban environment.

(1) Basic information

Date of investigation: _____

Investigation time: _____

1. You are:

a. 12-17 years old b. 18-24 years old c. 25-34 years old d. 35-59 years old e. more than 60 years old

2. Gender:

a. male b. female

3. Education level:

a. Junior or below (below nine grades) b. Senior high

c. Undergraduate d. Postgraduate or above e. Others

(2) Questions

1. The living distance between your home or place with the study area?

a. Very far (> l0km) b. Relatively far (5-10km) c. Moderated(2-5km) d. Not too far(1-2km) e. Very close(< l km)

2. What kind of transpotation do you usually use to come here?

a. bus b. taxi c. self-driving d. cycling e. walking

3. How often do you come here?

a. rarely b. low c. average d. often e. high

4. When do you usually come here?

a. 6-8am b. 9-11am c. 12-14pm d. 15-17pm e. after 18pm

5. How long do you usually stay here?

a. 15-30 minutes b. 45-60 minutes c. 1-2 hours d. 2-3 hours

e. > 3 hours

6. What is reasonable distance for rest spaces along the walking path?

a. <250 m (about half a stop) b. 250-500 m (about one stop)

c. 500-750 m (about one and a half stops) d. 750-1000 m (about two stops) e. ＞1000 m

7. What is the purpose you come here?

a. tourism b. exercise c. walk and breathe d. bath in the sun

e. other

8. How many people do you usually come with for this activity?

a. one b. two c. three d. four to six e. more than six

(3) Survey of space quality recognition

Grade: 1—poor 2—fair 3-average 4-good 5-excellent

1. Your satisfaction level with green quantity in this space environment 1 2 3 4 5

2. Your satisfaction level with vegetation type in this space environment 1 2 3 4 5

3. Your satisfaction level with sculpture or landmark quantity in this space environment 1 2 3 4 5

4. Your satisfaction level with sculpture or landmark style in this space environment 1 2 3 4 5

5. Your satisfaction level with large area lawn in this space environment 1 2 3 4 5

6. Your satisfaction level with tall tree cultivation in this space environment 1 2 3 4 5

7. Your satisfaction level with the quantity of rest seat in this space environment 1 2 3 4 5

8. Your satisfaction level with the style of rest seat in this space environment 1 2 3 4 5

9. Your satisfaction level with the quantity of public bathroom in this space environment 1 2 3 4 5

10. Your satisfaction level with the location of public bathroom in this space environment 1 2 3 4 5

11. Your satisfaction level with the style of public bathroom in this space environment 1 2 3 4 5

12. Your satisfaction level with the quantity of service kiosk in this space environment 1 2 3 4 5

13. Your satisfaction level with the location of service kiosk in this space environment 1 2 3 4 5

14. Your satisfaction level with the style of service kiosk in this space environment 1 2 3 4 5

15. Your satisfaction level with the quantity of trash bin in this space environment 1 2 3 4 5

16. Your satisfaction level with the location of trash bin in this space environment 1 2 3 4 5

17. Your satisfaction level with the style of trash bin in this space environment 1 2 3 4 5

18. Your satisfaction level with the quantity of information signs in this space environment 1 2 3 4 5

19. Your satisfaction level with the clarity of information signs in this space environment 1 2 3 4 5

20. Your satisfaction level with bicycle parking lot in this space environment 1 2 3 4 5

21. Your satisfaction level with vehicle parking lot in this space environment 1 2 3 4 5

22. Your satisfaction level with the quantity of children entertainment facilities in this space environment 1 2 3 4 5

23. Your satisfaction level with the safety of children entertainment facilities in this space environment 1 2 3 4 5

24. Your satisfaction level with the quantity of elderly activity facilities in this space environment 1 2 3 4 5

25. Your satisfaction level with the safety of elderly activity facilities in this space environment 1 2 3 4 5

26. Your satisfaction level with the quantity of fitness facilities in this space environment 1 2 3 4 5

27. Your satisfaction level with the type of fitness facilities in this space environment 1 2 3 4 5

28. Your satisfaction level with lighting type in this space environment 1 2 3 4 5

29. Your satisfaction level with lighting intensity in this space environment 1 2 3 4 5

30. Your satisfaction level with lighting aesthetics in this space environment 1 2 3 4 5

31. Your satisfaction level with accessible facilities in this space environment 1 2 3 4 5

32. Your satisfaction level with pavement texture in this space environment 1 2 3 4 5

33. Your satisfaction level with pavement color in this space environment 1 2 3 4 5

34. Your satisfaction level with pathway width in this space environment 1 2 3 4 5

35. Your satisfaction level with walkway route reasonality in this space environment 1 2 3 4 5

(4) Survey of spatial integrity

Level: 1—poor 2-fair 3-average 4-good 5-excellent

1. What do you think the transport connectivity with the city? — 1 2 3 4 5

2. What do you think the linkage with the city characteristics? — 1 2 3 4 5

3. What do you think the effect of government emphasizing and investigation on environment? — 1 2 3 4 5

4. What do you think the effect of planning level on environment? — 1 2 3 4 5

5. What do you think users' quality and cultivation? — 1 2 3 4 5

6. What do you think the degree of characteristics presentation of space along walkway?— 1 2 3 4 5

7. What do you think the necessity of setting closed green belt between urban arterial street and walkway? — 1 2 3 4 5

(5) Investigation of reform intention

Level: 1—strongly disagree 2—disagree 3—average 4—agree 5—strongly agree

1. Your support level of increase in indoor leisure space in this riverside pedestrian area— 1 2 3 4 5

2. Your support level of increase in theme exhibition or shows in this riverside pedestrian area — 1 2 3 4 5

3. Your support level of increase in E-vehicle in this riverside pedestrian area — 1 2 3 4 5

4. Your support level of increase in large business services in this riverside pedestrian area — 1 2 3 4 5

5. Thank you very much for your support and cooperation. Thank you for your more comments

_____

_____

_____

4.3.2 Basics of questionnaire distribution

The survey was conducted in three study blocks, namely, the Hangzhou Binjiang Section, the Hangzhou Canal Section and the Shaoxing Ancient Canal Section, and the data collected from the questionnaires are as follows.

The survey on waterfront area along canal of Hangzhou historical and cultural block was implemented via local questionnaire and online questionnaire respectively. Table 1 shows the basic information of all respondents. There are 558 respondents in total which has 330 local respondents and 228 online respondents.

The survey was conducted in April and May 2020. To reduce the contact between different respondents due to the COVID-19, the questionnaire survey was conducted at the mobile phone end rather than face-to-face ways. Overall, we received responses from 537 respondents, while only 306 samples were valid as some samples were incomplete.

A total of 336 questionnaires were obtained from the spatial behavior survey on the Shaoxing ancient canal section, including 6 online questionnaires and 330 field questionnaires.

4.4 Summary

4.4.1 Comparative analysis between the three study areas

According to the article 3.3.2, the study classifies the landscape types of waterfront areas based on contemporary urban forms: urban waterfront open space (new urban waterfront living area), canal landscape and urban leisure space (urban cultural tourism area), and historical waterfront landscape space to be developed (urban waterfront to be developed area). Then, three representative blocks with research value were selected, Hangzhou Binjiang Section, Hangzhou Canal Section, and Shaoxing Ancient Canal Section.

A profile analysis of the three blocks reveals a clear commonality of personality between the blocks.

In common: in terms of spatial form, the three areas are all born with water. The space shows the excessive effect of water-barge-land as well as the adaptation and transformation of the water system. In terms of living functions, all three areas are satisfied with the basic functions of living space such as circulation, leisure, distribution and entertainment; in terms of spatial adaptability, all three areas show spatial adaptability to the living habits of the surrounding population.

In terms of personality: In the landscape space of Hangzhou waterfront section, as a new urban development area, the activity crowd in the space is more concerned about the convenience of life in the space, such as the degree of supporting life and entertainment facilities, and the supporting facilities around the space. At the same time, the landscape of the new living waterfront area has a relatively high degree of matching to the future development of the city, which can be mapped out in the spatial arrangement, activity forms and planning design of the waterfront area to indicate the future development direction.

In the waterfront landscape space of the canal section of Hangzhou, the space is born with the canal and has a rich cultural heritage. The planning layout of the space not only reflects the living function, but also takes the tourism influence factor into consideration. The tourists' demand and desire for the canal waterfront space and the demand for the space pay more attention to the perception of history and culture than the residents. The space satisfies the functions of leisure, entertainment, and circulation, also reflects the deep traditional cultural connotation. In the form of activities, the canal waterfront area, because of the heavy culture it carries, is not only for leisure gathering, but also for activities to experience traditional folk culture. The future development of the space is both urban and historical.

In the waterfront landscape space of the ancient canal section of Shaoxing, although it is also a canal space, the development and protection of space utilization has yet to be improved. There is still a certain shortage of space function, the form is single, unattractive, and the space environment needs to be improved. At the same time, the residents' cultural awareness of the space is still relatively weak, and the cultural richness flowing in the waterfront space needs to be explored.

4.4.2 Design and interpretation of research questionnaire

When designing the questionnaire, from the perspective of spatial design, this paper, first of all, analyzed the main movers and shakers in the space by collecting basic information about them, and understood the explicit and implicit correlation between the space and the movers and shakers.

Secondly, it is necessary to understand the distance, mode of transportation and frequency of people arriving at the space in order to analyze the attractiveness of the space to the people. The peak and low frequencies of space use are identified by the time people spend in the space and the time they spend there. The main functionality of the current space for the crowd was determined by counting the specific facilities, number of peers, and intentions of the space. Again, a survey on the recognition of the quality of the space was conducted, setting questions on visual effects, services and facilities, recreational facilities, perception of space, and rationality of traffic, in order to fully understand the satisfaction with the current state of the waterfront space from all aspects. Finally, a survey on the intention of space renovation was conducted in order to determine the public's intention on the future direction of space renovation and development.

Reference

[1] Volume 2, Chapter 5: Hydrology. Shaoxing City Government Portal [Cite Date 2013-12-17]

[2] Social theater. Zhejiang Intangible Cultural Heritage [Cite Date 2015-07-28]

[3] The Grand Canal (Shaoxing), Shaoxing City Culture, Radio and Tourism Bureau Portal, 2020.

[4] Hua Wei, Xigang Zhu, Qiang Zhu. Transformation of Communication Space and Humanistic Neighborhood Place Architecture: Implications of Western Gentrification for Social Space in China's Megacities [J]. human geography,2005,20(3):117-121.

[5] Carmona M, Heath T, Oc T, et al. Dimensions of Urban Design: Public Places - Urban Spaces [M]. Nanjing: Jiangsu Science and Technology Press, 2005.

[6] Ying Long, Jiantin Zhao, Shuangjin Li, et al. Large-Scale Measurement of Street Walking Indices in Major Cities in China [J]. NEW ARCHITECTURE, 2018(3).

[7] Jane Jacobs. Death and life in American cities [M]. Nanjing: Yilin Publishing House, 2006.

[8] https://www.vergason.net/sundance-square-plaza.

[9] Gabriella Szaszák, Albert Fekete, Tibor Kecskés. Access to Waterfront Landscapes for Tourists Living with Disabilities. 2017, 5(1):5-13.

[10] Cho H. A study on the comparision of the visual attention characteristics on the facade image of a detached house due to the features on windows[J]. Journal of Asian Architecture & Building Engineering, 2016, 15(2) : 209-214.

[11] Daozeng Li. Introduction to Environmental Behavior [M]. Beijing: Tsinghua University Press, 1999.

[12] Rutledge. Translated by Wang Qiushi, et al. Public Behavior and Park Design [M]. Beijing: China Construction Industry Press, 1990.

[13] Yuan Yuan Chen, Xue Ping Gao, Chen Zhang. Research on Water Environment Problem for Landscape Design of Waterfront Districts. 2011, 1446:2414-2417.

[14] Difei Jiang. City Form Vitality Theory [M]. Nanjing: Southeast University Press, 2007.

[15] Jing Xia Liu, Zeng Qiang An. Analysis of the City Waterfront Landscape Design in Central Plains Economic Zone. 2012, 2080:395-399.

[16] Claire Cooper Marcus, Caroline Francis. Humanity Place: Guidelines for Urban Open Space Design [M]. Beijing: China Construction Industry Press, 2001.

[17] Hamid Xuwani. Urban design program [M]. Taipei: Chong Hing Publishing Co., Ltd., 1990.

[18] Qun Chen, Yan Bing Ye, Li Jin Ma. Excavation and Shaping of Distinctive Elements in Landscape Planning of Modern Urban Waterfront. 2011, 1366:12-17.

[19] Li Y. Street level urban design qualities for walkability: combining 2D and 3D GIS measures[J]. Computers, Environment and Urban Systems, 2017, 64 : 288-296.

[20] Jan Gal. translate by Renke He. Communication and space [M]. Beijing: China Construction Industry Press.2002.

[21] Shenglin Elijah Chang. The Danshui River Cultural Ecosystem as the Amis Tribal Landscape: An Asian Green-grassroots Approach. 2015, 170:463-473.

[22] Kongjian Yu. Landscape Sensitivity and Threshold Evaluation Study [J]. GEOGRAPHICAL RESEARCH，1991，10(2)：38-51.

[23] Prukin. translate by Linfei Han. Architecture and Historic Environment [M]. Hong Kong: Social Science Research Press.2011.

[24] Roger Transick. translate by Daqing Xie. Finding Lost Space [M]. Taipei: Chuang Hsin Press.1989.

[25] Lisa S. Krimsky, Mary G. Lusk, Holly Abeels, et al. Sources and concentrations of nutrients in surface runoff from waterfront homes with different landscape practices. 2020.

[26] Jin Duan，Jianqiang Yang，Chunning Xu. Some Reflections on the Deepening of Controlled Detailed Planning for Ancient Cities: A Pilot Study of No. 9 Neighborhood in Suzhou Ancient City as an Example [J]. City Planning，1999，(07)：57-59+63.

[27] Miranda McMinn, Scott Kirsch, Donald McNeil, et al. Review: Consuming Tradition, Manufacturing Heritage: Global Norms and Urban Forms in the Age of Tourism, Hybridity and its Discontents: Politics, Science, Culture, Waterfronts in Post-Industrial Cities, Manufacturing Montreal: The Making of an Industrial Landscape, 1850–1930, Skateboarding, Space and the City: Architecture and the Body. 2001, 33(11):2083-2088.

[28] Michael Batty, Ray Wyatt, Muki Haklay, et al. Review: Fluid City: Transforming Melbourne's Urban Waterfront, GIS, Environmental Modelling and Engineering, Landscape Simulation Modeling: A Spatially Explicit, Dynamic Approach, Profiling Machines: Mapping the Personal Information Economy, Surveillance as Social Sorting: Privacy, Risk and Digital Discrimination, Dialogues in Urban and Regional Planning 1. 2005, 32(2):305-316.

Chapter 5

SAMPLE CASE DATA RESULT PRESENTATION

CHAPTER FIVE: SAMPLE CASE DATA RESULT PRESENTATION

5.1 Hangzhou Binjiang section of Qiantang River

5.1.1 Background of sample selection and questionnaire recovery

Hangzhou is the capital of Zhejiang Province,China,is a very prosperous city in the Yangtze River Delta. It is also the core of the Hangzhou metropolitan area, consisting of 10 districts, one county-level city, and two counties. Meanwhile, Hangzhou is a populous city, where the 10 districts with an area of 8292.31 km^2, accommodate 8.24 million people (about 990 people/km^2). In particular, the six urban districts witness a much higher urban population density, with 706.27 km^2holding a population of 3.78 million (about 5350 people/km^2). The high population density has driven the replacement of urban natural land with manmade surfaces and brought significant challenges to urban environments (e.g. urban flooding, urban heat island effect) and further citizens' living quality.

Nevertheless, Hangzhou is a pioneering city embarking to reverse such situations. In particular, the local governments have released regulations and policies to promote urban greening and low-impact development. Fortunately, these urgent actions have taken into effects and natural environments have been significantly improved. For instance, the urban greening rate has been improved to 40.2%, the urban forestry coverage has been improved to 65.54% and the public green area per capita has been improved to 15.1 m^2. Accordingly, Hangzhou has been certificated as the 'National ecological garden city' among 300 'National garden cities'. These governmental efforts indicate the transitions of urban development and governance philosophy and practices. Such urban circumstances, therefore, enable us to further focus on the interaction between urban natural landscapes and citizens, namely the social performance of urban natural landscapes.

This study will focus on urban waterfront spaces for performing the analysis of the social performance of urban natural landscapes, as water landscape is a typical urban landscape in Zhejiang Province. In particular, the Qiantang River, alternatively known as 'Zhe River' and 'Zhe Jiang', is the origin of the name of Zhejiang Province. The most famous section of the Qiantang River relevant to the tide view is situated in Hangzhou city. Moreover, the riverside walkway is developed along the Qiantang River to provide people with a leisure, tourism and entertainment place that integrates landscape and ecology. Meanwhile, with the consideration of urban environmental problems, the riverside walkway is also aimed to create a healthy, comfortable and pleasant living environment for residents.

As shown in the Figure5- 1, the riverfront walkway is built on both banks (with the depth of 500–1000 m) of the Qiantang River. The north bank starts from the no.1 Qiantang River Bridge on the west and ends at no.2 Qiantang River Bridge on the east. In comparison, the south bank is situated

between no.1 Bingjiang Road (west side) and no.3 Qiantang River Bridge (east side). Overall, the Qiantang riverside landscape can be divided into three sections from the west to the east: natural landscape (on the west side of Baita), the transition from the natural landscape to urban landscape (between Baita and Fuxing Bridge) and the urban landscape (between Fuxing Bridge and no.3 Qiantang River Bridge). In particular, in the urban landscape section, there is a central business district between the no.1 and no.2 Qiantang River Bridge.

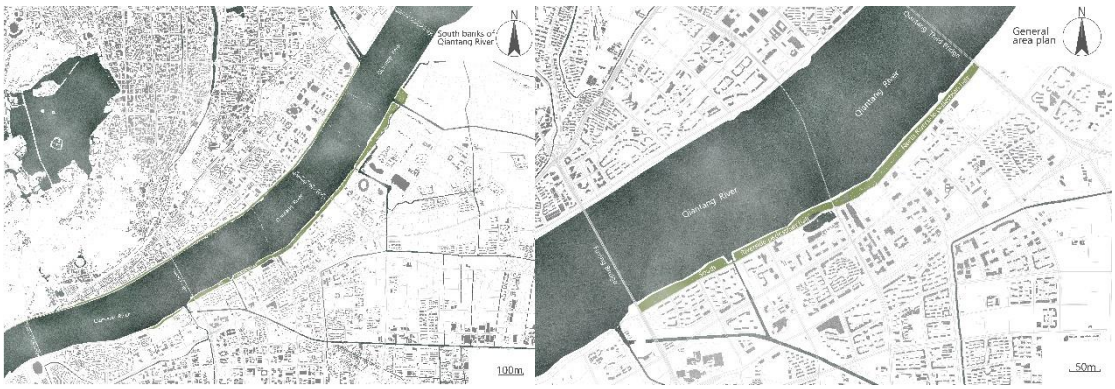

Fig. 5-1 The case study area Hangzhou Qiantang riverside walkway

The case study area is shown on the right of Figure 1. The case study area ranges between no.3 and no.4 Qiantang River Bridge in the west-east direction and ranges between the Qiantang River and Wentao Road in the northsouth direction, having a length of 3800 m and an area of 42.3 ha. In such an area, there are many high-end office buildings, commercial and residential building, and commercial blocks. This area also presents a mature landscape aiming to create a tourism city complex that focuses on tourism and integrates functions of culture, living, leisure, entertainment, communication and business. It should be mentioned that the Qianjiang Long Binjiang Park, with a diameter of 60 m, is the central node of the case study area. It is a centralised place for leisure, entertainment and tide viewing through a circular enclosure. Moreover, the Qianjiang Dragon Sculpture is a landmark icon of this park.

Overall, this waterfront space makes full use of the existing terrain and has designed double-layer viewing sheds to provide citizens with ideal places for entertainment, sightseeing and relaxation. From the dawn of the morning, some fitness people are running on the green fitness track or practising aerobics in a small area. At noon, residents and people working in surrounding office buildings come to take a walk or have a rest. In the evening, the study area can be densely populated, where most people come to enjoy the evening breeze and the night view of the city.

Since the case study area is an area for tourism and integrates leisure, entertainment, culture and living functions, citizens' activities are complex to describe, especially with the consideration of time dependence of citizens'activities. Therefore, to have an overall understanding of the social

performance of the urban waterfront space, the researchers conducted field observation to assess citizens' activities patterns. We divided the field investigation into three time periods including morning (7:50–8:50), around noon (12:00–15:00) and night (19:30– 20:50). In particular, it should be noted that the field investigation was performed between April and May 2020. During such period, the outdoor activities are limited with the governmental advocacy of staying at home due to the COVID-19 virus. Nevertheless, people's activities in the case study area could reflect citizens' strong preferences to the usage of such public spaces.

As shown in Figure 2, the components of the urban waterfront space are divided into five parts, including landscape (such as natural landscape, man-made landscape), public services (such as rest seat, public bathroom, service kiosk, trash bin, information signs and parking lot), main facilities (for example, children's entertainment, elderly activity, fitness), supporting facilities (for example, lighting and accessible facilities) and road functions (for example, pavement, pathway width, walkway route reasonability). In each part, concerns are relevant to various aspects such as the layout, quantity, safety and type. Through these, researchers can have a detailed understanding of urban waterfront space planning and design.

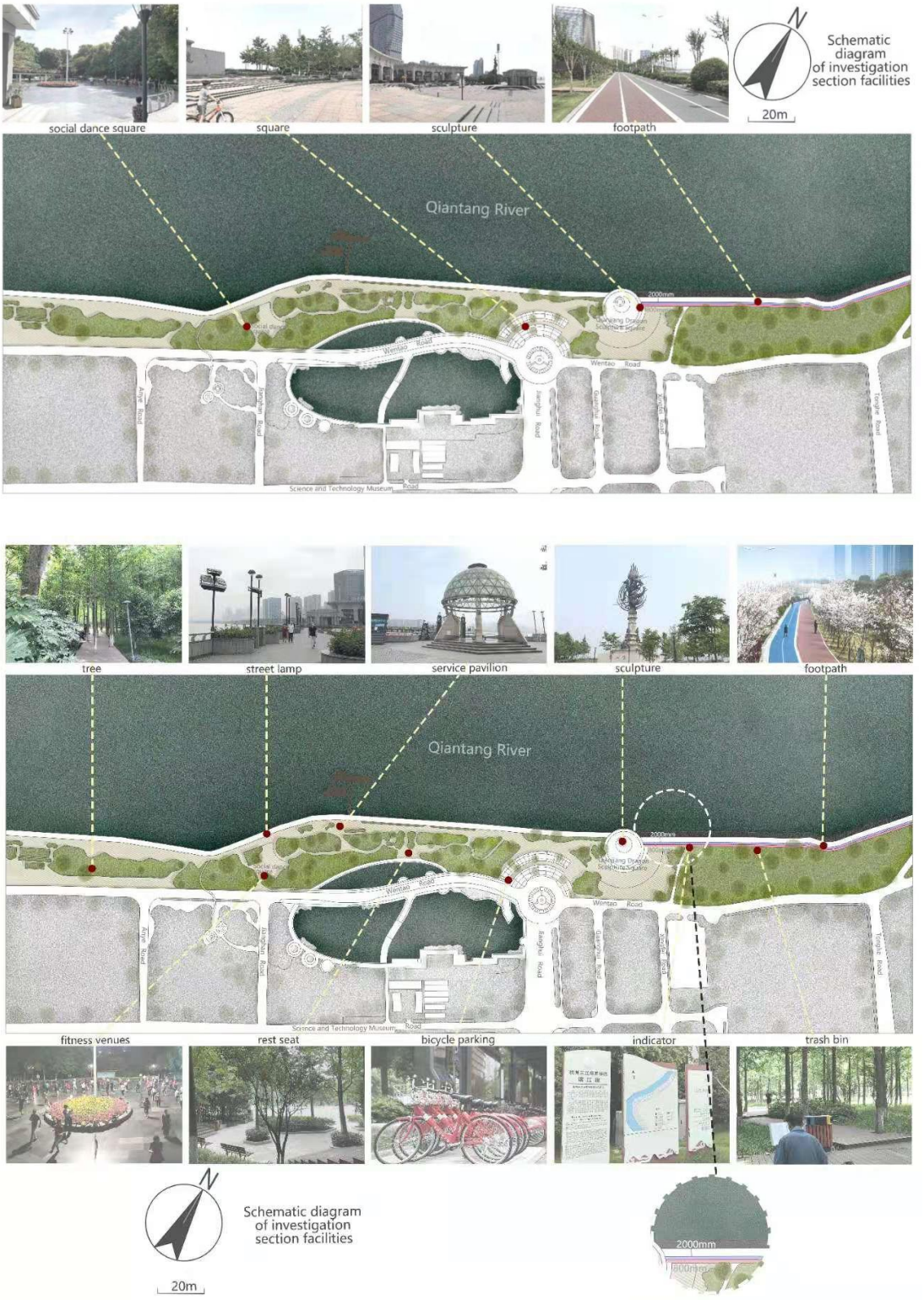

Fig. 5-2 The basic information of Hangzhou Qiantang riverside walkway

The survey was conducted in April and May 2020. To reduce the contact between different respondents due to the COVID-19, the questionnaire survey was conducted at the mobile phone end rather than face-to-face ways. Overall, we received responses from 537 respondents, while only 306 samples were valid as some samples were incomplete.

5.1.2 Field observation and analysis

This study mainly analysed the frequency of the responses from the citizens in order to have a detailed understanding of the social performance of the Qiantang riverside walkways. Moreover, the average score of different components was calculated for comparing respondents' satisfaction towards the performance of different aspects. During this process, the one-sample t test was used to make sure whether the average score of each factor was significant or not. Moreover, the comparative analysis was conducted through the independent t test to examine whether there were significant differences between similar aspects (e.g. rest seat quantity, rest seat style). If the results from the comparative analysis were not significant, the similar aspects could be considered as a cluster in the urban planning and design.

Before the questionnaire survey, we conducted the field observation to examine people's activity in the Qiantang riverside walkway. A set of images were taken to illustrate the real scenarios of people activity, as given in Fig. 5-3.

Fig. 5-3 The field observation of people's activity in the Qiantang riverside walkway

Overall, the field observation indicates there were significantly temporal differences in people's activity. In the morning (6:00–8:00), there were a few people doing morning exercises in the square and children entertainment areas. There was a slight increase in the people who were doing morning exercises, especially in the square between 9:00 and 12:00, while other people were mainly under tree shades. Between 12:00 and 14:00, as well as between 14:00 and 17:00, the occurrence of people who were playing decreased, while there could still be found some people having rest under the dense tree shades, as well as the vehicle on the road. In the night, between 19:30 and 20:50, many people were exercising and entertaining in the children entertainment area, square and the main road.

5.1.3 Questionnaire data statistics

①Basic information of respondents

A total of 306 respondents were surveyed via mobile phone end with the questionnaire of the social performance of the Qiantang riverfront walkway. Table1presents the basic information of all respondents. The questionnaire consists of 114 men (37.3%) and 192 women (62.7%), which may indicate women group was about 2 times the men group in presence in the riverfront walkway. Concerning the age of interviewees, three groups of 18–24, 25–34 and 35–59 accounted for 98% of all respondents. The age group of 18–24 accounted for the largest proportion (36.3%), slightly higher than the proportion (34.3%) of the people who were between 35 and 59 years old. The proportion of the people aged 25–34 was 27.5%. Such results indicate there was no obvious stratification in the age groups. For the education background, there were obvious differences among different levels, where most people (50.0%) held the undergraduate education background, followed by the people (31.4%) who had the senior high education. People who had a postgraduate or above education and people who received other forms of education (i.e. vocational education) accounted for 5.9% and 12.7%, respectively. However, no respondent fell into the group of junior or below education background.

Table 5-1 The basic information of respondents

	No.	Frequency (%)		No.	Frequency (%)
Gender			Education		
Male	114	37.3	Junior or below (below nine grades)	0	0.0
Female	192	62.7	Senior high	96	31.4
			Undergraduate	153	50.0
			Postgraduate or above	18	5.9
			Others	39	12.7
Age			Living distance from here		
12-17	6	2.0	Very far (>10 km)	96	31.4
18-24	111	36.3	Relatively far (5-10 km)	54	17.6
25-34	84	27.5	Moderated (2-5 km)	54	17.6
35-59	105	34.3	Not too far (1-2 km)	57	18.6
>60	0	0.0	Very close (< 1 km)	45	14.7

②Statistics of living distance from waterfront

On the living distance from the case study area, people who lived very far (> 10 km) accounted for the largest proportion (31.4%). For the remaining respondents, their living distance can be divided into four groups with similar proportion, such as 18.6% for not too far (1–2 km), 17.6% for relatively far (5– 10 km), 17.6% for moderated (2–5 km) and 14.7% for very close (< 1 km), respectively. The results evidence the Qiantang riverside walkway played a mixed role in city tourism and local leisure and entertainment.

③Transportation pattern and activities of respondents

Figure 5-4 present respondents' behaviours in terms of the way to come and their activities in the Qiantang riverside walkway. Regarding the transportation pattern, 31.4% of people came here through self-driving. This is followed by the people (28.4%) who came here by bus, and then cycling (22.5%) and walking (12.7%). 4.9% of people came here depending on the taxi. It is found that the proportion (31.4%) of people who selected self-driving was equivalent to the proportion (31.4%) of the people who lived very far from here (Table 1). The sum of proportion (35.2%) of the people who selected cycling and walking was similar to the proportion (33.3%) of the people who lived within 2 km (Table 1). For the frequency coming here, most people (52.9%) come with a frequency of lower than average, with 35.3% for low frequency and 17.6% for extremely low (rare) frequency, respectively. People who come here with an average frequency and those who often come here accounted for 22.5% and 21.6%, respectively. Only 2.9% of people came to the study area very frequent.

④Frequency and timing of the interviewee's arrival in this space

According to the time that people generally come here, the proportion gradually increased from the morning to night. In particular, at night (after 18:00), the proportion (47.1%) of visitors reached the peak, about three times the proportion of the visitors in the period of 14:00–17:00 (18.6%), 12:00– 14:00 (14.7%) and 9–12 am (13.7%). The presence of people obtained through the questionnaire survey was consistent with the results presented in the field observation. People who came here before 8 am only accounted for 5.9%. On the time duration, most people (66.7%) stayed here less than 60 min, where 41.2% of people stayed here for 30–60 min and 25.5% of people stayed here for 15-–30 min. Following this, 23.5% could stay here for 1–2 h, while very few people could stay here for 2 h (3.9%) or more than 3 h (5.9%).

For the setting of rest space, most people (51.0%) suggested reasonable distance should be 250–500 m, while 26.5% of the people thought it would be reasonable to set rest spaces in 250 m. The distance of 500–750 m could be reasonable for 9.8% of the respondents, 750–1000 m for 11.8% of the respondents and more than 1000 m for only 1% of the respondents. People who came here for walking and breathing fresh air accounted for 38.2%, followed by the proportion (27.5%) of the people who came for exercising and then 16.7% of the respondents came for tourism. It should be noted that no one purely came for a bath in the sun, while 17.6% of the respondents came for other purposes. More than 90% of the respondents came here with less than three people, where 42.2% came with other two, 25.5% with only one and 23.5% came solely. Such results indicate the Qiantang riverside walkway was not for group reunion or activities.

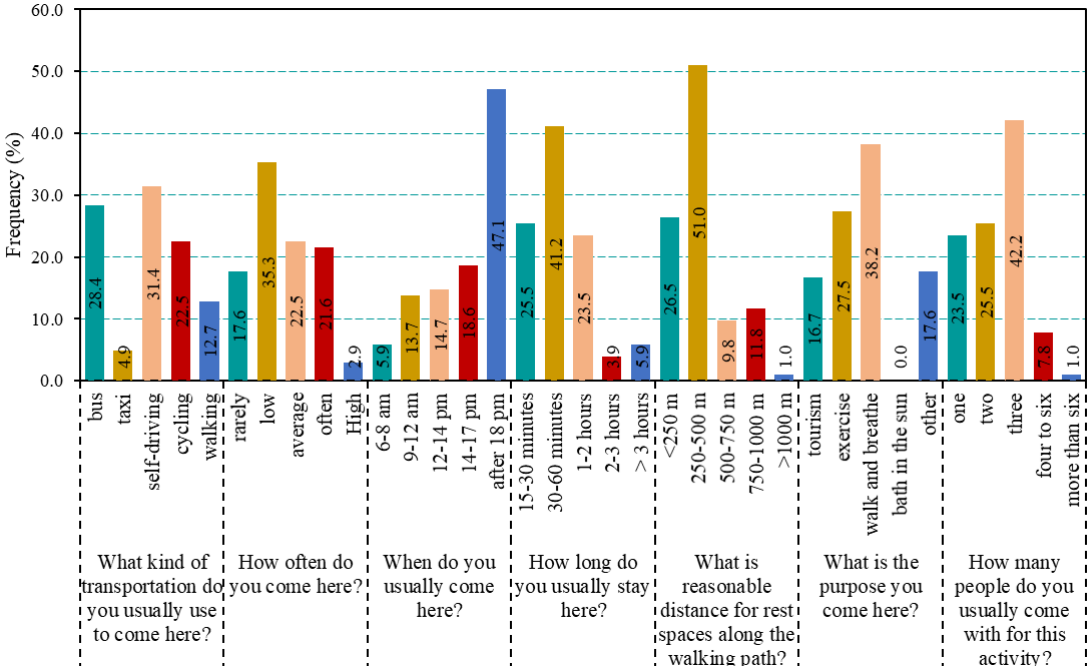

Fig. 5-4 Respondents' behaviours in terms of the way to come and their activities

⑤Satisfaction level to the settings of the Qiantang riverside walkway

This section presents respondents' preference and attitudes towards the components of the Qiantang riverside walkway in terms of landscape, public service, main facilities, supporting facilities and road functions.

（1）Satisfaction level of landscape

Figure 5-5 illustrates respondents' sanctification level to the landscape, such as the greening quantity, vegetation type, sculpture or landmark style, sculpture or landmark quantity, large area lawn and tall tree cultivation. Respondents generally had a good satisfaction to the settings of landscapes, as the average satisfaction level of six aspects was all-around 4.00. The satisfaction level (4.09) of greening quantity was the highest among six aspects, followed by satisfaction level (4.06) of vegetation type, and then that of sculpture or landmark style (4.05), large area lawn (4.03) and tall tree cultivation (4.02). However, the score of the sculpture or landmark quantity was the lowest but still reached 3.97. This indicates the necessity to improve the sculpture or landmark style for better satisfaction level.

A further analysis was conducted to examine the frequency of different level of responses to six aspects. The 'excellent' score of the greening quantity was 39.2%, the highest proportion of the 'excellent' score among six aspects, and the 'good' score of the greening quantity was 37.3%, ranking the thirdhighest among the 'good' score among six aspects. In comparison, vegetation type had the highest proportion (47.1%) of 'good' score among six aspects and it received the lowest 'excellent' score (32.4%) among six aspects. The proportion of 'good' and 'excellent' score of the remaining aspects all exceeded 30%, apart from the proportion (29.4%) of 'good' score of large area lawn. In addition, the sculpture or landmark style received the highest 'fair' score (8.8%) among six aspects and the tall tree cultivation received the highest 'average' score (22.5%) among six aspects. Such results have scrutinized the reason resulting in the lowest satisfaction level of sculpture or landmark style and the second lowest satisfaction level of tall tree cultivation.

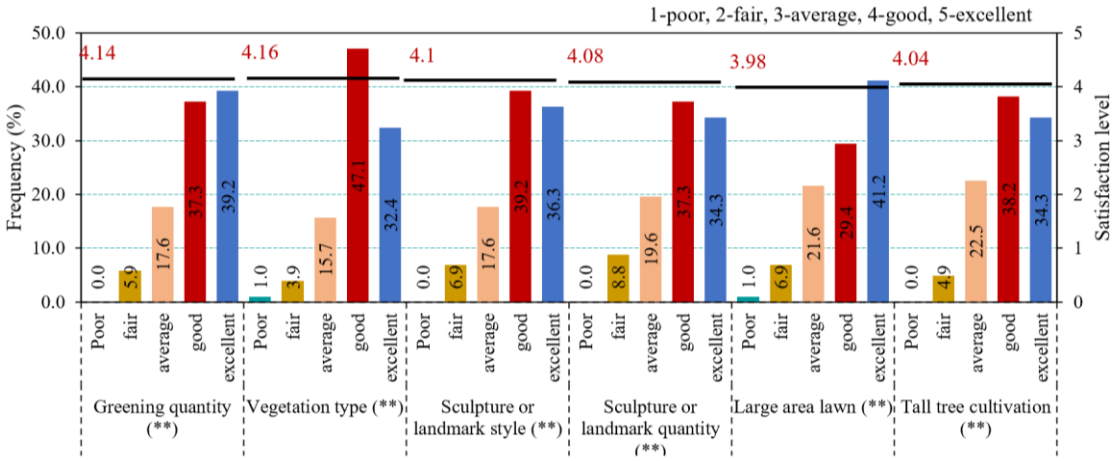

Fig. 5-5 Satisfaction level of landscape among 306 respondents (double asterisks indicate the data with significant results according to one-sample t test ($p < 0.01$) (2-detailed))

（2）Satisfaction level of public service

Table 5-2 presents respondents' response to the public service and whether the public service can meet respondents' requirements. The satisfaction level ranged between average and good, as the average scores of 15 aspects all ranged between 3.61 and 3.89.

Table 5-2 Satisfaction level of public service in terms of rest seat, public bathroom, service kiosk, trash bin, information signs and parking lot

Question	Frequency of responses (%) (n=102)					Mean	SD	Rank	Sig. (2-tailed)
	1	2	3	4	5				
rest seat (quantity)	1.0	9.8	29.4	34.3	25.5	3.74	0.98	6	0.000
rest seat (style)	0.0	9.8	30.4	37.3	22.5	3.72	0.94	8	0.000
public bathroom (quantity)	2.0	16.7	25.5	30.4	25.5	3.61	1.10	15	0.000
public bathroom (location)	1.0	14.7	30.4	27.5	26.5	3.64	1.06	13	0.000
public bathroom (style)	1.0	10.8	31.4	31.4	25.5	3.70	1.00	10	0.000
service kiosk (quantity)	3.9	7.8	25.5	34.3	28.4	3.74	1.07	6	0.000
service kiosk (location)	2.9	7.8	31.4	31.4	26.5	3.70	1.05	10	0.000
service kiosk (style)	2.9	5.9	36.3	29.4	25.5	3.69	1.01	12	0.000
trash bin (quantity)	2.0	8.8	27.5	33.3	28.4	3.78	1.02	3	0.000
trash bin (location)	2.0	7.8	32.4	29.4	28.4	3.75	1.02	5	0.000
trash bin (style)	3.9	6.9	27.5	33.3	28.4	3.76	1.07	4	0.000
information signs (quantity)	1.0	7.8	28.4	31.4	31.4	3.84	0.99	2	0.000
information signs (clarity)	0.0	6.9	28.4	33.3	31.4	3.89	0.93	1	0.000
parking lot (bicycle)	0.0	12.7	33.3	24.5	29.4	3.71	1.03	9	0.000
parking lot (vehicle)	2.0	14.7	32.4	21.6	29.4	3.62	1.12	14	0.000

Note: 1-poor, 2-fair, 3-average, 4-good, 5-excellent

The overall satisfaction level indicates the necessity of improving public services, especially the quantity of public toilet (3.61 scores). Moreover, the average score of 15 aspects indicates the stratification and agglomeration of respondents' satisfaction. For instance, information signs in

terms of clarity and quantity had the highest scores of 3.89 and 3.84 among 15 aspects. Trash bin received 3.78, 3.76 and 3.75 in terms of quantity, style and location, ranking at 3rd, 4thand 5thplace, respectively. The rest seat received 3.74 and 3.72 in terms of quantity and style, ranking the 6thand 8th, respectively. The setting of the public toilet was not reasonable, with its style, location and quantity receiving 3.70, 3.64 and 3.61, ranking at 10th, 1 3thand 15th, respectively.

A further scrutinisation to the frequency of different responses indicated that only the proportion of 'excellent' score in information (e.g. quantity, clarity) reached 30%. The rest seat received the lowest proportion of'excellent'score (25.5% and 22.5% in quantity and style, respectively), but it received the highest proportion of 'good' score (34.3% and 37.3% for quantity and style, respectively) which held the overall rank of rest seat in the middle place. For the items that received the lowest rank, such as the public bathroom, parking lot and service kiosk, more than 43% of the respondents thought public bathroom failed to perform well, where the 16.7% and 14.7% of the respondents thought quantity and location of the public bathroom could only perform fairly. The parking lot could only perform fairly among 12.7% (bicycle) and 14.7% (vehicle) of respondents.

（3）Satisfaction level of the main service

Figure 5-6 demonstrates respondents' satisfaction degree towards main service as well as the detailed responses to six aspects, such as children entertainment facilities (quantity, safety), elderly activity facilities (quantity, safety) and fitness facilities (quantity, type). The satisfaction degree of supporting service ranged between 3.67 and 3.78, indicating the main service could not perform well generally. There was no obvious difference among six aspects, where the fitness facility type had the highest satisfaction degree (3.78), only slightly higher than the lowest satisfaction degree of 3.67 received by the quantity of children entertainment facilities. In addition, the satisfaction level also exhibited the phenomenon of stratification and agglomeration, where the quantity (3.77) and type (3.78) of fitness facilities ranked the highest, while the children entertainment facilities ranked the lowest in both quantity (3.67) and safety (3.69).

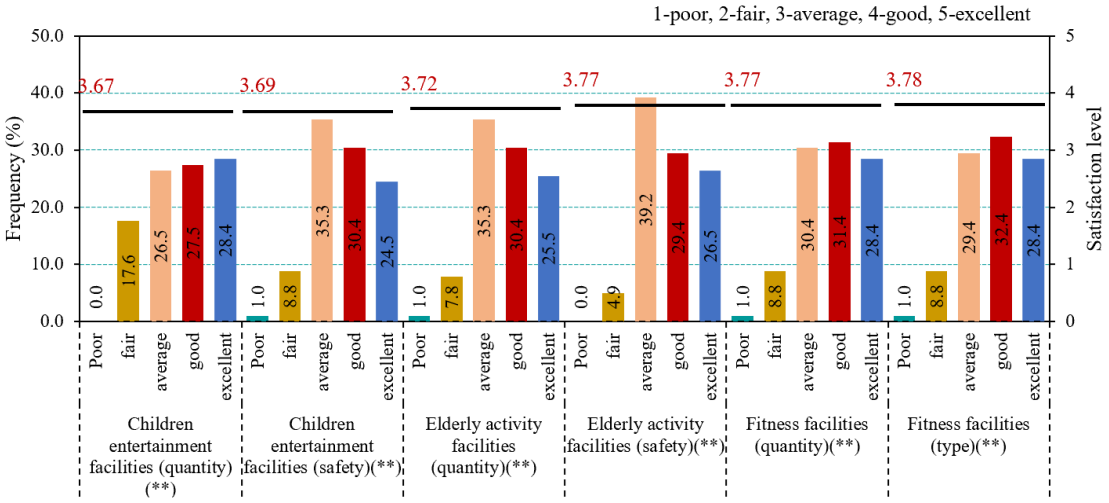

Fig. 5-6 Satisfaction level of the main service among 102 respondents (double asterisks indicate the data with significant results according to one-sample t test ($p < 0.01$) (2-detailed))

The detailed responses to six aspects of main facilities indicate that people could have diverse responses to their performance, where the proportion of 'average', 'good' and 'excellent' groups all exceeded 25%. Nevertheless, in terms of the safety of children entertainment facilities, the number of elderly activity facilities and the safety of elderly activity facilities, people who thought the public service only reach an average level in performance accounted for the highest proportion, about 35.3%, 35.3% and 39.2% in value, respectively. Nevertheless, most people (about 55%) thought that such aspects could perform well or the best in meeting their requirements. Moreover, for the quantity of children entertainment facilities, 17.6% of the respondents thought it was fair to meet the requirements.

（4）Satisfaction level of supporting service

The supporting service was considered in terms of lighting (e.g. type, intensity, aesthetics) and accessible facilities. The survey results are presented in Fig. 5-7. Respondents generally had 'good' satisfaction with the supporting facilities, especially for the lighting intensity (4.04) and aesthetics (4.04). Meanwhile, the scores of lighting type and accessible facilities approached to 4.0, roughly indicating people thought the lighting type and accessible facilities performed well. A further track of the detailed response indicated that most people were satisfied with supporting services as the proportion of 'good' and 'excellent' groups exceeded 72%. Nevertheless, there were 19.6% (lighting type), 14.7% (lighting intensity), 17.6% (lighting aesthetics) and 20.6% (accessible facilities) of the respondents who thought the supporting services only performed at an 'average' level. In comparison, less than 8% of the people ranked the supporting facilities at the 'poor' and 'fair' level.

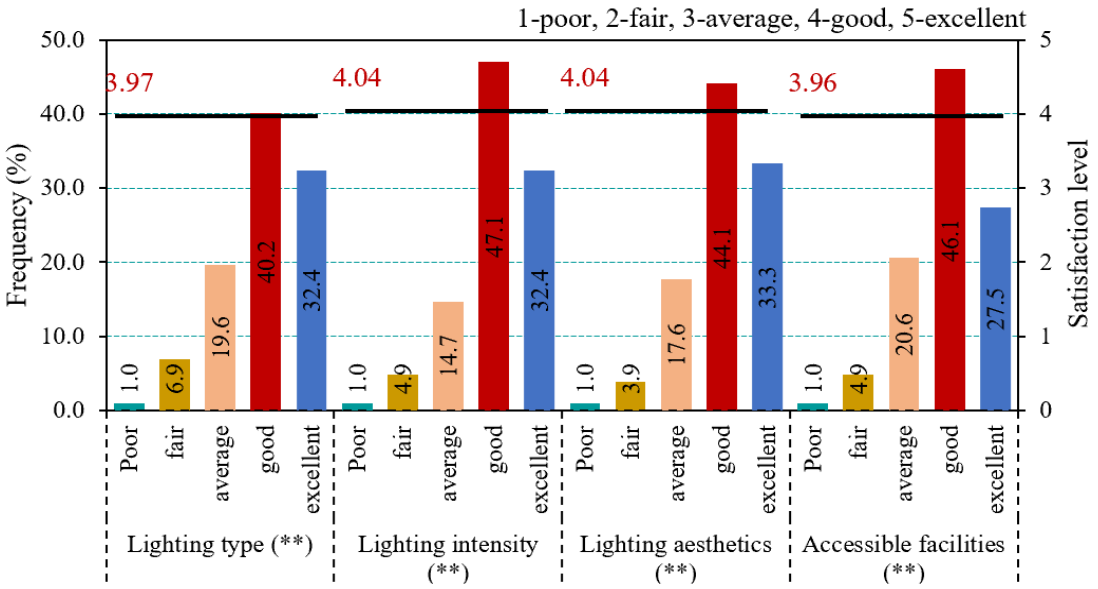

Fig. 5-7 Satisfaction level of supporting service among 102 respondents (double asterisks indicate the data with significant results according to one-sample t test ($p < 0.01$) (2-detailed))

（5）Satisfaction level of road functions

Figure 5-8 presents respondents' response to the road functions and whether the road functions can meet respondents'requirements. The results overall suggest that most people thought the road could well fulfill their functions, with a satisfaction level of 4.04 for pavement texture, 4.05 for pavement colour, 4.08 for pavement width and 4.10 for walkway route reasonability. Moreover, there were slight differences in the degree of satisfaction towards different aspects. Further analysis of the detailed responses to the road functions indicates most people (> 75%) ranked the road performance at 'good' and 'excellent' levels. Yet still, 17.6% (pavement texture), 19.6% (pavement colour), 18.6% (pavement width) and 16.7% (walkway route reasonability) of the respondents thought the road could only obtain 'average' satisfactions. Fortunately, less than 5% of the respondents thought the road performed poorly or fairly.

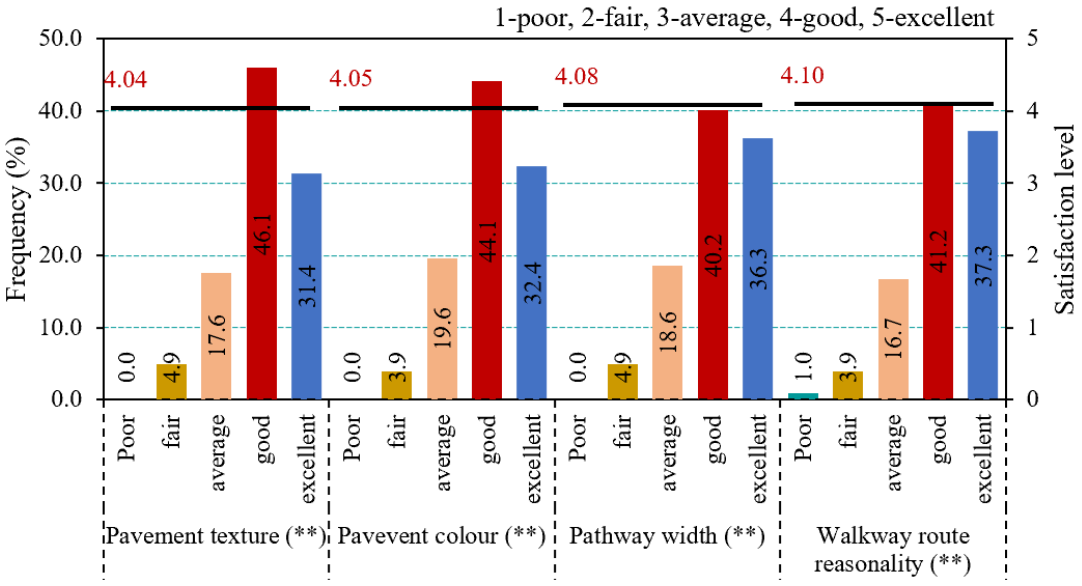

Fig. 5-8 Satisfaction level of road functions among 102 respondents (double asterisks indicate the data with significant results according to one-sample t test (p < 0.01) (2detailed))

⑥Assessment of the overall quality of the Qiantang riverside walkway

The interviewees were also invited to assess the overall quality of the Qiantang riverside walkway in terms of the transport connectivity with the city, linkage with the city characteristics, users' quality and cultivation, space personality and quality of green belt in isolating freeway. Figure 10 presents respondents' attitudes towards such aspects. The results indicate the Qiantang riverside walkways had a 'good' linkage with city characteristics, with an average score of 4.02. At the same time, the urban waterfront space studied could well exhibit its space personality, having different characteristics and forming specific atmospheres from other tourism spaces, with an average score of 4.02. The transport overall could not perform well in connecting the city with the Qiantang riverside walkway, with an average score of 3.84. Respondents thought the setting of the green belt performed well to isolate freeways surrounding the Qiantang riverside walkway, with an average score of 4.17. Such results may indicate the quality of the Qiantang riverside walkway was affected significantly by the freeway (e.g. safety, noise, air pollution). Respondents also indicate visitors had good quality when using the Qiantang riverside walkway, with an average score of 4.02.

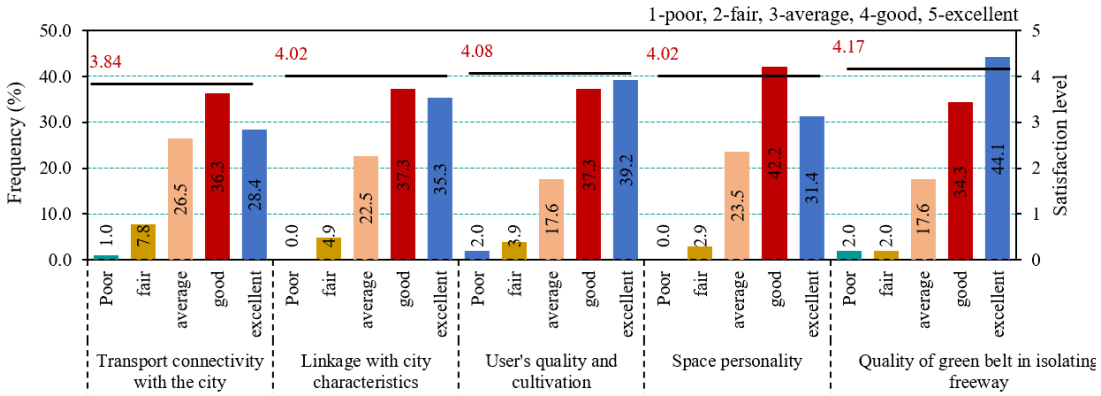

Fig. 5-9 Satisfaction level of overall quality among all respondents

The detailed responses to each aspect indicated that the people who thought 'green belt' had the 'excellent' performance accounted for the largest proportion of 44.1%, followed by the 'user's quality and cultivation' (39.2%), and then 'linkage with city characteristics' (35.3%),'space personality' (31.4%) and 'transport connectivity with the city' (28.4%). Space personality received the highest proportion of 42.2% in 'good' ranking, followed by the proportion (37.3%) of user's quality and cultivation and that (37.3%) of linkage with city characteristics. Regarding the transport connectivity with the city, 26.5% of the respondents thought that the transport connectivity performed averagely and 7.8% of the respondents thought the transport connectivity only performed fairly, all the highest among five aspects.

⑦Opinions on the renovation of the Qiantang riverside walkway

Further analysis of citizens' responses to the renovation of the Qiantang riverside walkway was conducted in terms of increases in indoor leisure space, increases in theme exhibition or shows, increases in E-vehicle and the increases in large business services, as illustrated in Fig. 5-10. The results indicate that people had a strong preference for the increase in indoor leisure space (4.20) and the increase in theme exhibition or shows (4.12). The people who strongly thought indoor leisure space was essential accounted for 41.2% and those who agreed accounted for 33.3%. Regarding the increase in theme exhibition or shows, 41.2% of the respondents strongly agreed and 31.4% agreed. For the increase in E-vehicle, most people (53.9%) thought it was essential. However, the people who had an average need accounted for the highest proportion of 31.4%, while 8.8% and 5.9% of the respondents disagreed and strongly disagreed, respectively. For the business services, the score of 3.90 was also not sufficient to support the conclusion of the agreement or strong agreement, as 7.8% and 4.9% of the respondents strongly disagreed and disagreed, respectively. Meanwhile, 25.5% of the respondents had an average need.

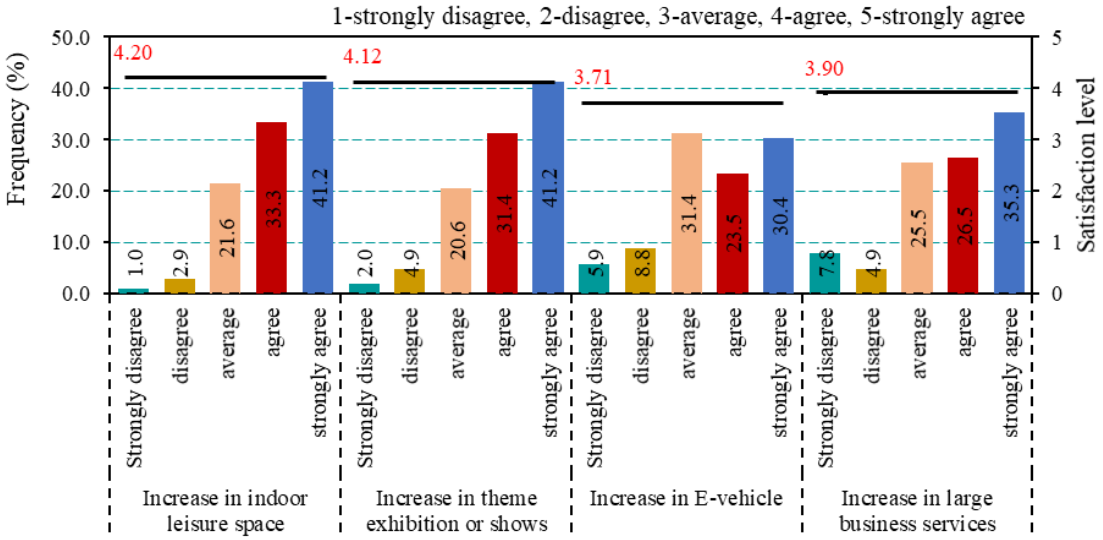

Fig. 5-10 Respondents' opinion on the renovation of Qiantang riverside walkway

5.2 Hangzhou section of Beijing-Hangzhou Grand Canal

5.2.1 Background of sample selection and questionnaire recovery

The survey area of this Hangzhou canal section is the two waterfront spaces of Gongchen Bridge. Gongchen Bridge is located in Gongshu district, Hangzhou, and crosses the Beijing-Hangzhou Grand Canal. It is the highest and longest stone arch bridge among the ancient Bridges in Hangzhou, and also the landmark building at the southern end of the Grand Canal. "A Gongchen Bridge is half the history of Hangzhou". The special spatial position of Gongchen Bridge determines that it is not only a bridge connecting traffic, but also carries hundreds of years of history, culture and emotional memory.

Fig. 5-11 Waterfront walking space and sculpture landscape

The survey on waterfront area along canal of Hangzhou historical and cultural block was implemented via local questionnaire and online questionnaire respectively. Table 1 shows the basic information of all respondents. There are 558 respondents in total which has 330 local respondents and 228 online respondents. The respondents consists of 258 male(46.24%) and 300 female(53.76%), which shows among the people in presence of survey area, there are a little more women than men. Among the respondents, there are 513 people aged 18-59, which accounted for 91.94%. Among the people aged 18-59, the age group of 25-34 takes the largest part, which accounted for 41.40%; the age group of 35-59 accounted for 30.11% and the age group of 18-24 accounted for 20.43%. There are a few people aged 12-17 and aged more than 60, which accounted for 4.84% and 3.23% respectively.

For the educational background, there are 363 respondents(65.05%) who received university education or higher than university education. Among the 363 respondents, 303(54.30%) of them have bachelor degree, 60(10.75%) of them have master degree or Ph.D. 28 respondents(15.05%) received senior high education. 33 respondents(5.91%) received junior high and lower education. 78 respondents(13.98%) received other education or have other educational experience.

For the distance between respondents residences and survey area, there are 138 respondents(24.73%) live at the distance of more than 10km; 135 respondents(23.12%) live at the distance of 2km-5km; 87 respondents(15.59%) live at the distance of 2km approximately; 69 respondents live in 1km far from survey area. According to surroundings in situ in survey area, the survey area is a business and cultural traveling district and there are plenty of restaurants, providing entertainment and leisure for citizens in Hangzhou.

Table 5-3 The basic information of respondents

	No.	Frequency(%)
Gender		
Male	258	46.24%
Female	300	53.76%
Age		
12-17	27	4.84%
18-24	114	20.43%
25-34	231	41.40%
35-59	168	30.11%
>60	18	3.23%
Education		
Junior or below(below nine grades)	33	5.91%
Senior high	84	15.05%
Undergraduate	303	54.30%
Postgraduate or above	60	10.75%
Others	78	13.98%
Living distance from here		
Very far(>10 km)	138	24.73%
Relatively far(5-10 km)	129	23.12%
Moderated(2-5 km)	135	24.19%
Not too far(1-2 km)	78	15.59%
Very close(<1 km)	69	12.37%

5.2.2 Field observation and analysis

Figure 5-13 presents the methods which respondents came to survey area and their activities there. In accordance to survey, respondents who came to survey area by bus accounted for 32.3%, and followed by people came there by self-driving(25.3%), then cycling(19.4%) and walking(12.4%), only 10.8% of people came there by taxi. Comparing with data above, the number of people who waking to survey area is the same as the number of people who dwell form survey area at the distance of 1km(Fig.1). For the frequency that respondents came to survey area, people who came there lower than average frequency accounted for 37.7%, with 22.6% at the frequency of low and 15.1% of respondents at the frequency of rarely respectively. People who came there at the average frequency and those often came there accounted for 39.8% 15.6% respectively, only 7.0% of people came there at high frequency.

Dividing the period that people perform activities in survey area into 5 parts, they are 06:00-08:00, 09:00-11:00, 12:00-14:00, 15:00-17:00 and after 18:00 respectively. According to questionnaires, the number of people who came to survey area reached the peak(41.9%) when night came(after

18:00). There are 5.4% of respondents in survey area in the early morning(06:00-08:00). Then more people(14.0%) came to survey area in the morning. The number of people decreased slightly at noon(12:00-14:00), it accounted for 12.9%. In the afternoon(15:00-17:00), the proportion of people raised again and reached 25.8%.

Fig. 5-12 Time recording and shooting of Hangzhou Canal section

For the time people staying in survey area, according to questionnaires, most people(81.2%) stayed there less than 2 hours, among them there are 14.5% staying there for 15-30 minutes, 30.1% staying there for 45-60 minutes, 36.6% staying there for 1-2 hours. There are only 9.1% of all respondents staying there for 2-3 hours, 9.7% staying there for more than3 hours.

For the proper distance of leisure space along walkways, most respondents(87.7%) suggested shorter than 750m and below, with 26.9% of respondents suggested 250m, 45.7% of respondents suggested 500m, 15.1% of respondents suggested 750m. There are 9.7% of all respondents suggested 1000m, and least people(2.7%) suggested more than 1000m.

For activity varieties, the most favorable activity is tourism, which took 33.3% of respondents, followed by walking and breathing fresh air, which took 28.5% of respondents, then 25.3% of respondents came there for exercising, and there are 12.4% of respondents doing other activities, only 0.5% of respondents sunbathing there.

Most respondents(90.8%) came to survey area together with less than 2 people. 37.6% of respondents came there with 2 partners, 28.5% respondents came there with 1 partner, and 24.7% of respondents came there alone. 6.5% of respondents came there with 3-5 partners, and there are only 2.7% of respondents came there with more than 5 partners.

In accordance to the function of business and cultural tourism of survey area, analyzing with information above it can draw conclusion that, respondents tended to having entertainment with some friends and exercising in afternoon or at night in survey area, and people were incline to walk in survey area. People who came to survey area inhabited far from there generally, and people usually stayed for short time there. The conclusion indicates that this area provides leisure, shopping and catering for surrounding area and it would not be proper to large group activities.

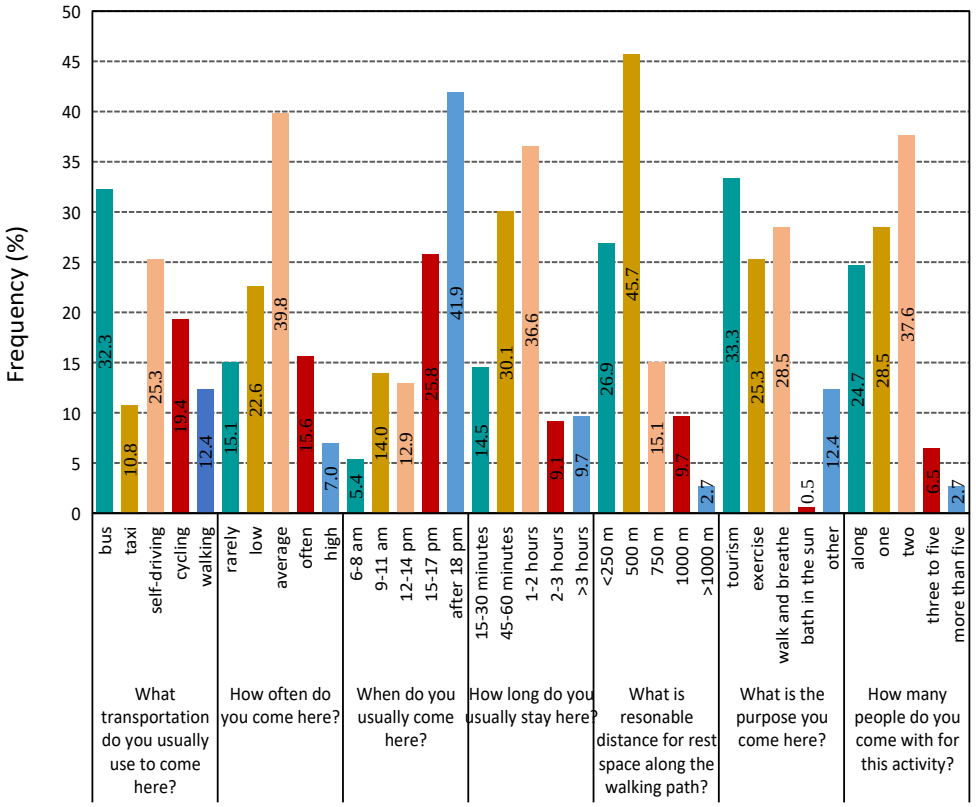

Fig. 5-13 Respondents' behaviours in terms of the way to come and their activities

5.2.3 Questionnaire data statistics

①Satisfaction level of the settings of survey area

This section presents respondents' satisfaction level to landscape, public service, main facilities, supporting facilities and road functions in survey area.

（1）Satisfaction level of landscape

Figure 5-14 presents respondents' satisfaction level to landscape in survey area. There are 6 criterion which are greening quantity, vegetation type, sculpture or landmark style, sculpture or landmark quantity, large area lawn and tall tree cultivation respectively. Respondents have a high satisfaction level about landscape in survey area generally, the average satisfaction level of every criterion are(4.00) approximately. The highest satisfaction level 4.09 was given to greening quantity; the lowest satisfaction level(3.89) was given to sculpture or landmark style. Both satisfaction level of vegetation type and large area lawn are 4.05, tall tree cultivation reaches 4.03 and sculpture or landmark quantity reaches 3.92. According to figure 5-15, the opinion of respondents toward landscape are almost the same, every criterion's variance is below 1, the largest one(0.8) happens in

large area lawn, the smallest one(0.61) happens in vegetation type. This result illustrates that the landscape in survey area satisfies people well.

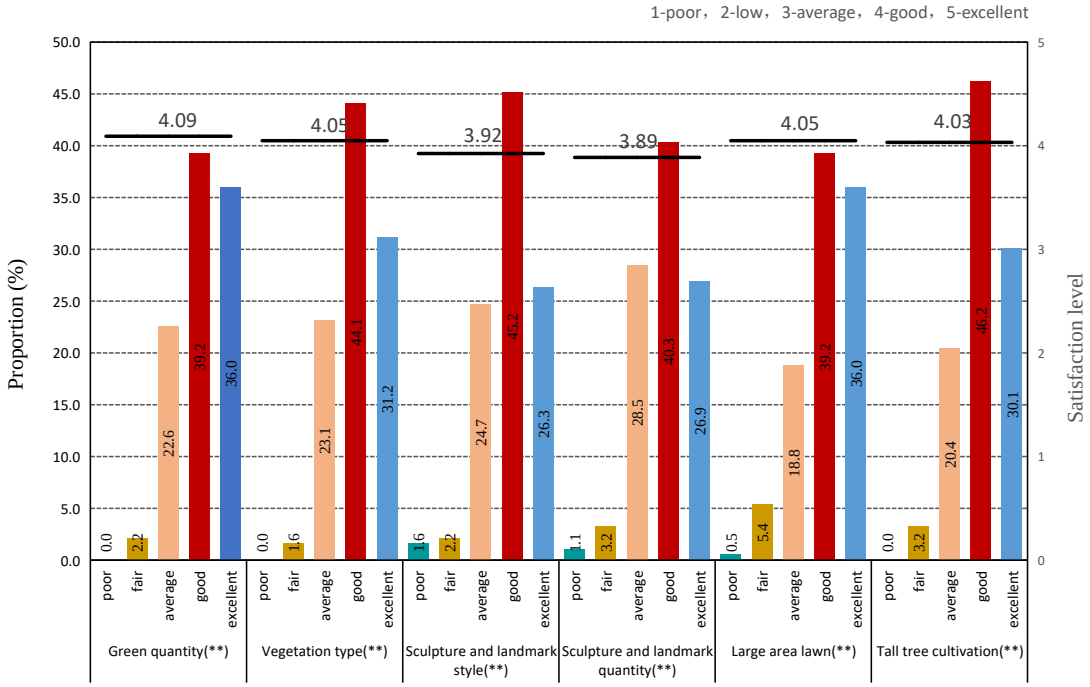

Fig. 5-14 Satisfaction level of landscape

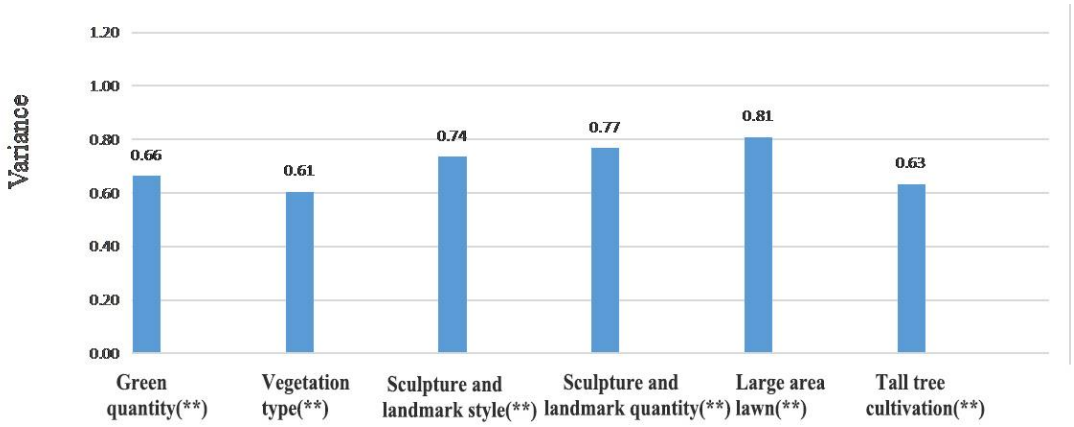

Fig. 5-15 Variance of criterion

（2）Satisfaction level of public service

Table 5-4 presents respondents' satisfaction level of public service and the level of public service satisfying respondents. 15 criterion's satisfaction level ranged between average and good, as the average scores ranged between 3.70 and 4.01.

The satisfaction level indicates that existing public service in survey area met people's demands well, but it can be improved in some aspects. Among 6 main criterion the highest scores was given to information signs, which quantity was given 4.00, clarity was given 4.01, and both value of standard deviation are below 0.8. It presents that information signs express information clearly and the number of information signs is adequate, respondents are satisfied with setting of information signs generally. And followed with main criterion of trash bin, which quantity was given 3.90, location was given 3.92 and style was given 3.92, and all value of standard deviation are above 0.8. It indicates that trash bins can meet people's demand basically, however, it failed in meeting certain people's special demands which caused respondents' different opinion toward trash bins. Then followed with main criterion of public bathroom, which quantity was given 3.90, location was given 3.92 and style was given 3.92, and all value of standard deviation was close to 0.9. It demonstrates that setting of public bathroom can meet people's demand basically, but still need to be improved in certain detail. For the rest seat, it received 3.88 in quantity and 3.83 in style respectively, both value of standard deviation are between 0.9 and 1, which indicates the quantity and style can be improved. For service kiosk, it was given 3.94 in quantity, 3.82 in location and 3.86 in style, and all value of standard deviation are above 0.9, which illustrates that the quantity of service kiosk is basically enough but location and style can be optimized. The last one is parking lot, which bicycle parking lot received 3.82 ranked 13 and vehicle parking lot received 3.70 ranked 15, both value of standard deviation are larger than 0.9, analyzing with situation of survey area, the conclusion demonstrates that the survey area locates in busy area and suffers severe traffic jam. More parking lots should be built close to survey area and taking public traffic to survey area should be widely propagandized and encouraged.

Table. 5-4 Satisfaction level of public service in terms of rest seat, public bathroom, service kiosk, trash bin, information signs and parking lot

Questions	Frequency of Response(%) (n=186)					Mean	SD	Rank	Sig.(2-tailed)
	1	2	3	4	5				
rest seat (quantity)	1.08	6.99	25.81	35.48	30.65	3.88	0.96	10	0.000
rest seat (style)	1.08	5.38	27.96	40.86	24.73	3.83	0.90	12	0.000
public bathroom (quantity)	0.54	4.30	29.03	36.56	29.57	3.90	0.89	8	0.000
public bathroom (location)	0.54	5.38	23.66	41.94	28.49	3.92	0.88	6	0.000
public bathroom (style)	0.54	4.30	27.96	37.10	30.11	3.92	0.89	7	0.000
service kiosk (quantity)	1.08	5.91	22.58	39.25	31.18	3.94	0.93	5	0.000
service kiosk (location)	1.08	6.45	29.03	36.56	26.88	3.82	0.94	13	0.000
service kiosk (style)	1.08	5.38	26.34	40.86	26.34	3.86	0.91	11	0.000
trash bin (quantity)	0.54	3.23	25.27	43.55	27.42	3.94	0.84	4	0.000
trash bin (location)	1.08	4.84	22.04	39.78	32.26	3.97	0.91	3	0.000
trash bin (style)	0.00	5.38	27.96	38.17	28.49	3.90	0.88	9	0.000
information signs (quantity)	0.00	1.61	24.73	45.70	27.96	4.00	0.77	2	0.000
information signs (clarity)	0.00	2.15	24.19	44.62	29.03	4.01	0.79	1	0.000
parking lot (bicycle)	0.54	8.06	26.34	39.25	25.81	3.82	0.93	13	0.000
parking lot (vehicle)	1.61	9.14	29.57	37.10	22.58	3.70	0.97	15	0.000

Note：1-poor，2-fair，3-average，4-good，5-excellent；sig(2-tailed) was obtained based on t-test.

（3）Satisfaction level of main service facilities

Figure 5-16 presents respondents' satisfaction level of main service facilities, there are three main criterion which are children entertainment facilities(quantity, safety), elderly activity facilities(quantity, safety) and fitness facilities(quantity, type) respectively. The overall satisfaction level are low compared to public service, scores ranged from 3.61 to 3.81, and the difference of respondents' opinions is relatively large, the largest variation is 1.16 and the smallest variation is 0.96. In the criterion of children entertainment facilities, quantity received 3.61 and variance was 1.16; safety received 3.70 and variance was 1.11. For elderly activity facilities, quantity received 3.79 and variance was 1.05; safety received 3.81 and variance was 0.96. In the criterion of fitness facilities, quantity received 3.74 and variance was 1.07; type received 3.74 and variance was 1.08. It can be concluded from data above that the design of main service facilities ignored the vulnerable relatively and was unable to meet people's variable fitness demands.

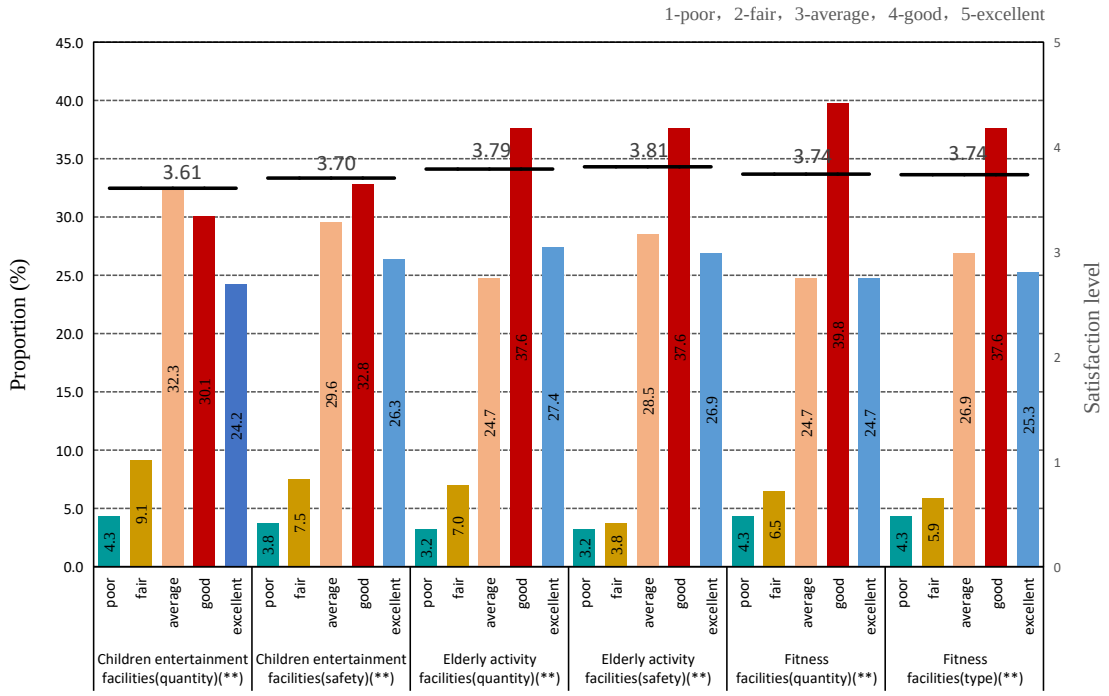

Fig. 5-16 Satisfaction level of the main service

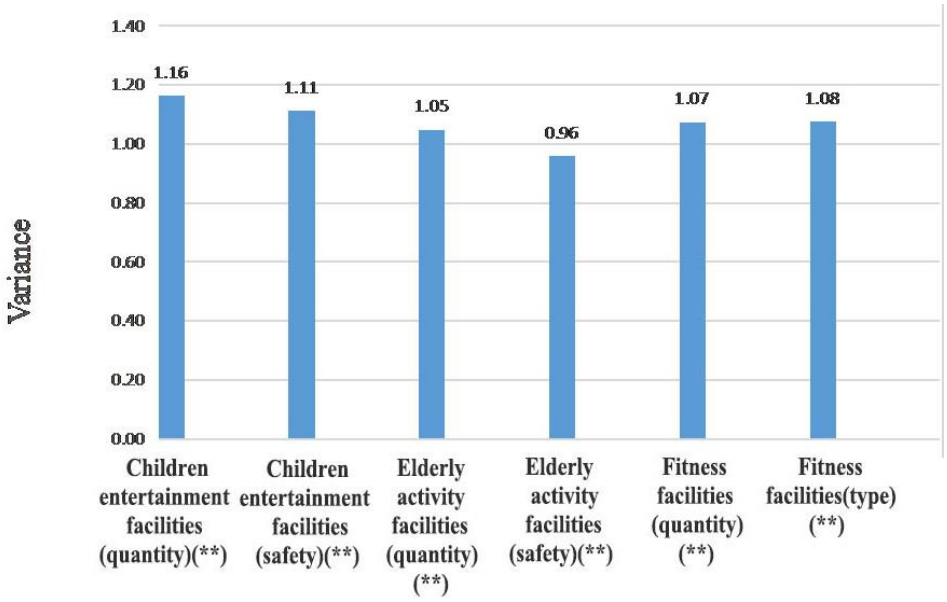

Fig. 5-17 Variance of criterion

（4）Satisfaction level of supporting service facilities

Figure 5-18 presents satisfaction level of supporting service facilities. There are 2 main criterion in total which are lighting(type, intensity, aesthetics) and accessible facilities respectively.

Respondents satisfied with lighting service relatively but think poorly of accessible facilities. Lighting type received 4.02 and variance was 0.68; lighting intensity received 4.11 and variance is 0.63; lighting aesthetics received 4.08 and variance is 0.60. Accessible facilities received the lowest score 3.76 and the largest variance 1.04. This is because most people neither use it nor pay attention to it, but the minority feel inconvenience when using accessible service, so there were large difference in respondents' opinion. It indicates accessible service facilities need to be optimized greatly.

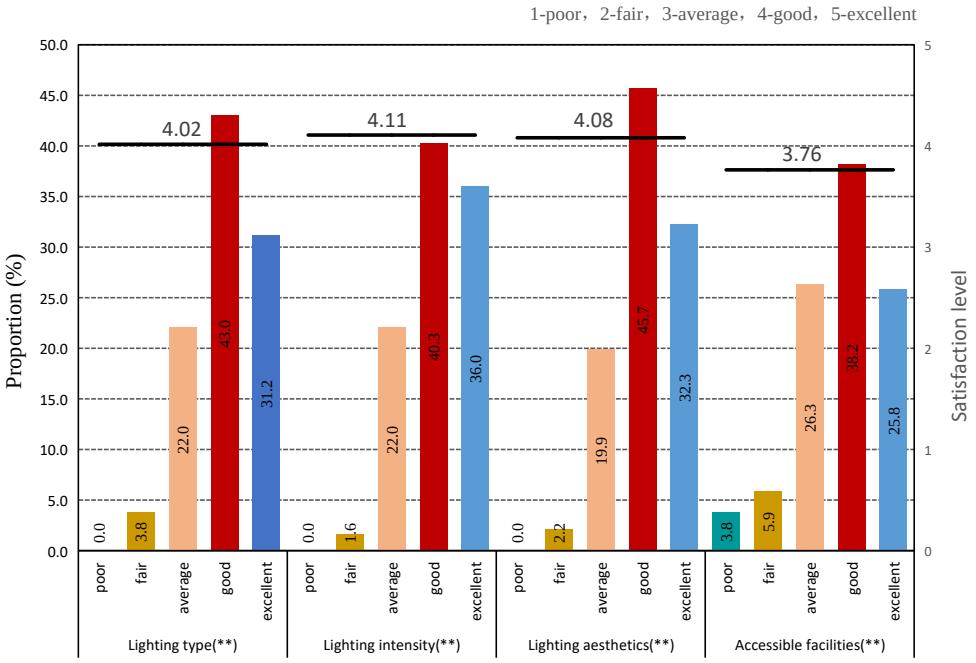

Fig. 5-18 Satisfaction level of supporting service

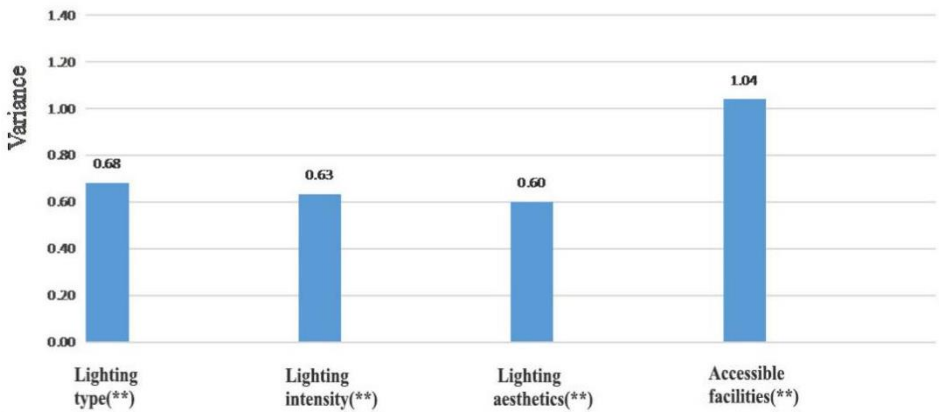

Fig. 5-19 Variance of criterion

（5）Satisfaction level of road function

Figure 5-20 presents respondents' satisfaction level of road function. There are 4 criterion which are pavement texture, pavement colour, pavement width and walkway route reasonability respectively. Respondents were relatively satisfied with road function, the scores are ranged from 3.99 to 4.06, and the variance ranged from 0.62 to 0.71, which indicates respondents were generally satisfied with road function. Pavement texture received 3.99 and variance was 0.62; pavement colour received 4.01 and variance was 0.71; pavement width received 4.04 and variance was 0.64; walkway route reasonability received 4.06 and variance was 0.65. In accordance to data above, people were satisfied with walkway route reasonability mostly, however, pavement texture need to be optimized.

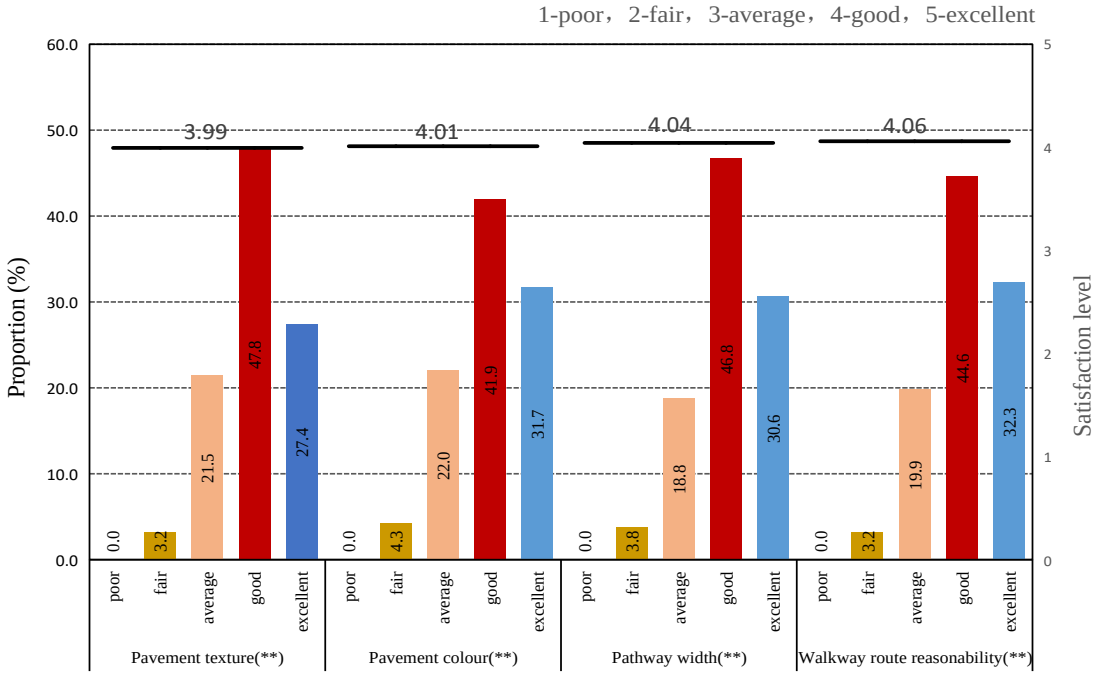

Fig. 5-20 Satisfaction level of road functions

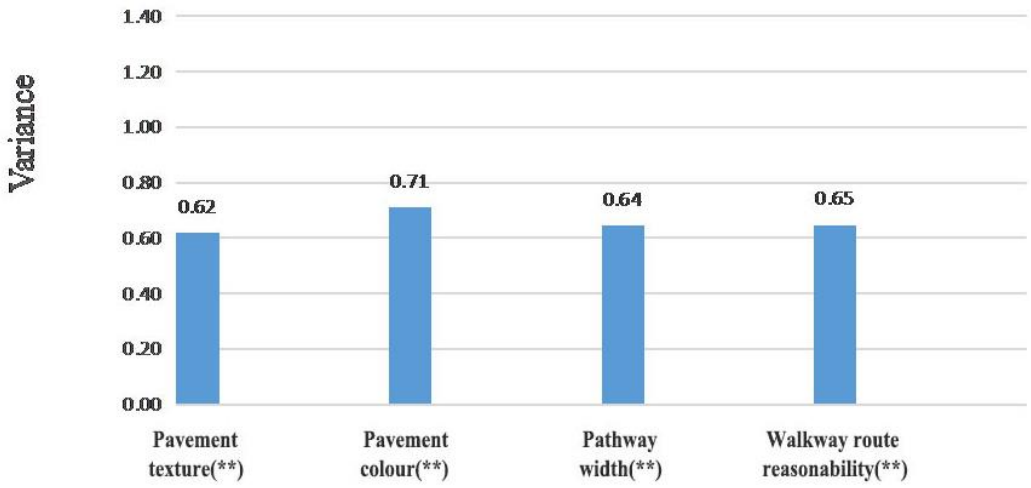

Fig. 5-21 Variance of criterion

②Assessment of the overall quality of the survey area

Respondents were also invited to assess overall quality in the aspects of transport connectivity with the city, linkage with the city characteristics, effect of government emphasize and investigation on environment, effect of planning level on environment, users' quality and cultivation, space personality and the necessity of setting closed green belt between arterial street and walkway. Among the criterion transport connectivity with the city scored 4.04, linkage with the city characteristics scored 4.08, both effect of government emphasize and investigation on environment and necessity of setting closed green belt between arterial street and walkway scored 4.20, effect of planning level on environment received the highest score 4.25, users' quality and cultivation received 4.15 and space personality scored 4.11.

On the basis of analyzing above, people feel 'good' on the overall quality of survey area. In scoring effect of planning level on environment and necessity of setting closed green belt between arterial street and walkway the respondents who scoring 'excellent' took the largest part, which demonstrate that people were pleased with planning level and green belt of survey area. However, the respondents who scoring 'good' took the largest proportion in other criterion, it indicates that there are still potential for survey area to upgrade.

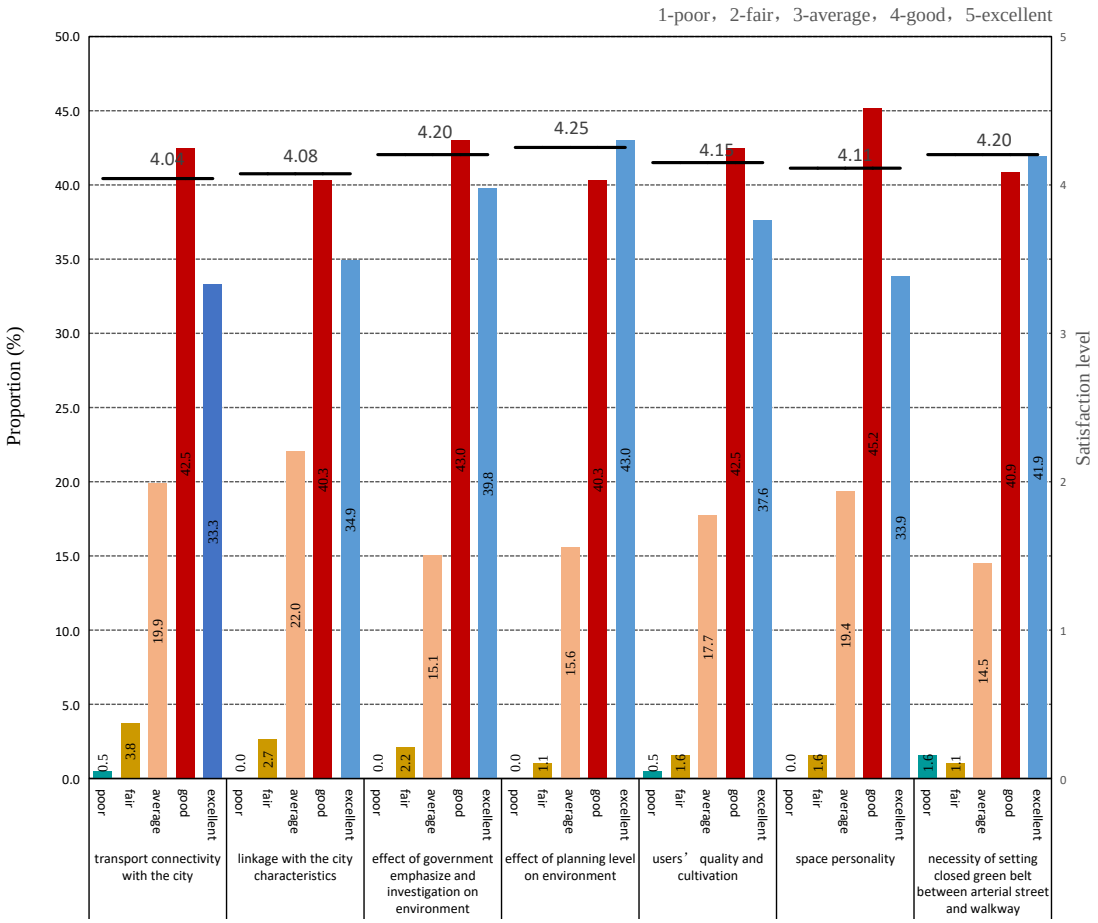

Fig. 5-22 Satisfaction level of overall quality

③Opinions on the renovation of the survey area

Furthermore, this survey also questioned respondents about opinions on the renovation of the survey area, and results is presented in Figure 5-23. In accordance to results that people have strong will in increasing indoor leisure space and theme exhibition or shows, these tow criterion was scored 4.16 and 4.09 respectively. In the criterion of increasing indoor leisure space, 41.4% of respondents chose 'strongly agree' , 37.6% respondents chose 'agree'. For increasing theme exhibition and shows, 39.8% of respondents chose 'strongly agree', 37.1% of respondents chose 'agree'. For increasing e-vehicles and large business services, people's will decreased, they were scored 3.76 and 3.88 respectively. For increasing e-vehicles, 32.3% of respondents chose 'strongly agree', 30.1% of respondents chose 'agree', 3.8% of respondents chose 'strongly disagree' and 10.8% of respondents chose 'disagree', 23.1% of respondents chose average. For increasing large business services, 36.6% of respondents chose 'strongly agree',32.8% of respondents chose 'agree', however, 4.8% and 8.1% of respondents chose 4.8% and 8.1% respectively, 23.1% chose average.

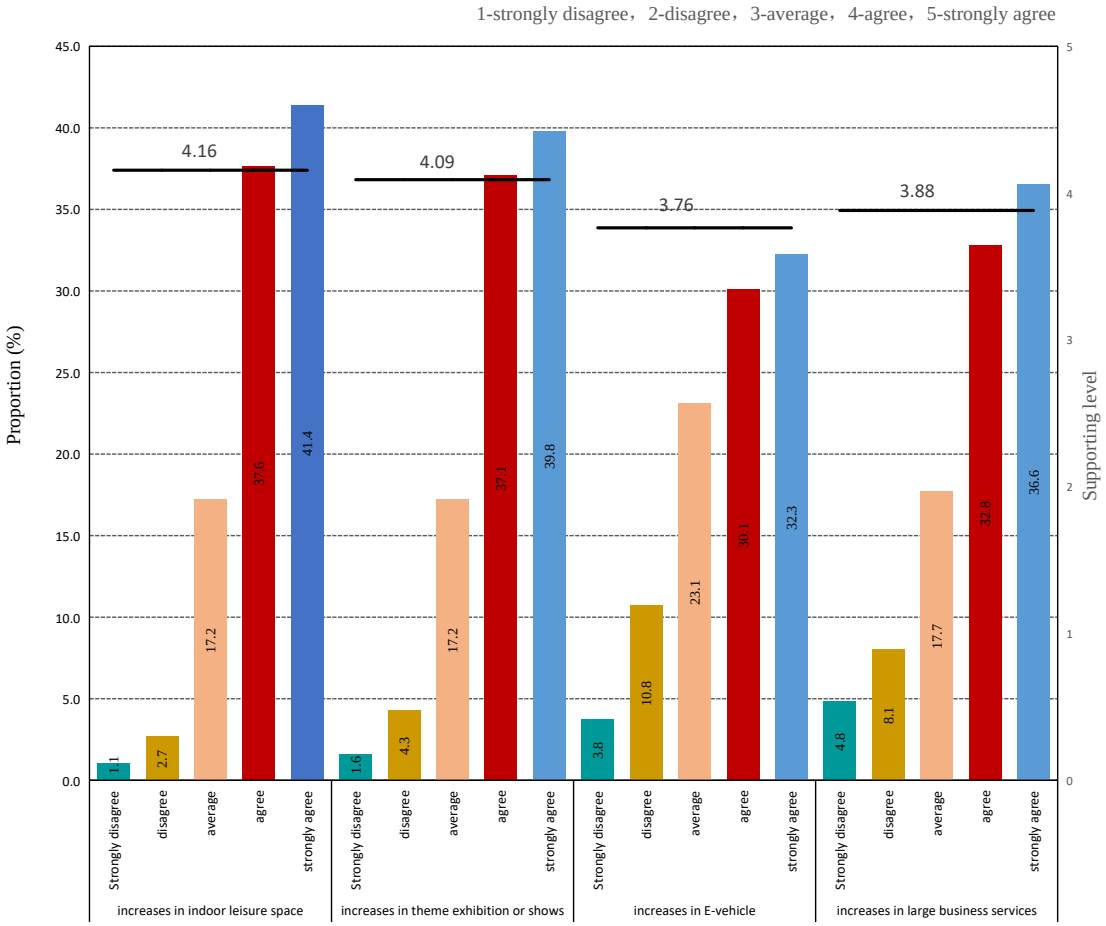

Fig. 5-23 Respondents' opinion on the renovation of survey area

5.3 Shaoxing Ancient Canal

5.3.1 Backgroung of sample selection and questionnaire recovery

The urban waterfront spaces are one of the most sensitive areas in the urban environment. It is closely related to the city's economic, political, cultural, social, ecological and many other factors. In addition to transportation, the function of the canal bears more of the development of the city and people's lives. With the development of modern society, new functional requirements have conflicts with the interface of the canal. The traditional architectural interface of some canal towns along the river Preservation is incomplete. New constructions and structures spread to horizon. The height of buildings is uneven, and the volume and style of some new buildings are inconsistent with the historical environment along the canal. All of these have caused the historical authenticity as well as a feature along the urban canal to disappear, destructing historical surroundings consequently. In some economically developed canal towns, orderly construction is more serious. The building

facades of some sections along the canal have changed greatly, and the development of many sections is gradually eroding the canal space.

The ancient canal of eastern Zhejiang is connected to the Jiangnan Canal via the Qiantang River. It starts from the ancient town of Xixing in Hangzhou in the west, flows through Shaoxing, and reaches Ningbo in the east and connects with the Maritime Silk Road. It consists of multiple tracks and the length is about 276 kilometers. Among them, the Shangyu section is located in the middle section of the ancient canal in eastern Zhejiang (Figure 1), connected to Y uyao City to the east, and the overall appearance is distributed in a "Y" shape. The first section, western line is called "Xiao Cao Canal". It enters Shangyu from Dongguan Street, Danshan Village, and flow into Cao'e River, which is about 10.7 kilometers long. The second section, southern line is called "Sishili River", which starts from Lianghu Weir, flows through Fenghui Town, and flows from Anjiadu Village, Y onghe Town to Y uyao, with a total length of about 23 kilometers. The third section, northern line is called the "Y uyu Canal", starting from Zhaojia Village, Baiguan Street, Shangyu in the west, to Yiting Town in the east, flowing into Yuyao and get connected to Y ao River, with a total length of 15.7 kilometers. This article takes the 1.6 kilometer waterfront spaces on the north bank of the ancient canal section of Baiguan Street, Shangyu District, Shaoxing City as the field investigation section. The minimum width of the river bank landscape zone is about 7 meters, and the maximum width is about 45 meters.

Fig. 5-24. Map of the Beijing-Hangzhou Grand Canal(top left), Map of the Yuyu Grand Canal(top right), Map of research site ancient canal section (bottom)

A total of 336 questionnaires were obtained from the spatial behavior survey on the north bank of the ancient canal section of Baiguan Street, Shangyu District, Shaoxing City, including 2 online questionnaires and 110 field questionnaires. The basic information of respondents is presented in the Table 5.

① Basic information of respondents

Table 5-5 The basic information of respondents

	No.	Frequency (%)
Gender		
Male	162	48.2
Female	174	51.8
Age		
12-17	39	11.6
18-24	72	21.4
25-34	81	24.1
35-59	81	24.1
> 60	63	18.8
Education		
Junior or below (below nine grades)	81	24.1
Senior high	120	35.7
Undergraduate	108	32.1
Postgraduate or above	15	4.5
Others	12	3.6
Living distance from here		
Very far (> l0km)	24	7.1
Relatively far(5-10km)	42	12.5
Moderated(2-5km)	81	24.1
Not too far(1-2km)	96	28.6
Very close(< l km)	93	27.7

Analyzing this table, we can get that the proportion of men is 48.2% and the proportion of women is 51.8%, indicating that there is no obvious gender difference between these respondents. Concerning the age of interviewees, people over 18 accounted for 88.4% of the total population. Among them, the proportion of respondents in the 25-34 and 35-59 age ranges was 24.1%, higher than the proportion (21.4%,18.8%) of the people who were in the 18-24 years old and over 60 years old. For the education background of these respondents, only 36.7% of people have a bachelor degree or above, including 32.1% with a bachelor's degree and 4.5% with a master's degree. The persons with the largest proportion is who had the senior high education (35.7%). It also exists people with junior high school education or below (24.1%) and other forms of education (3.6%). Overall analysis shows that the majority of respondents in Shaoxing's ancient canal section have high school and undergraduate degrees.

In the survey of the distance between the residence and the case study area, it can be divided into five groups, such as Very close (< 1km), Not too far (1-2km), Moderated d (2-5km), Relatively far (5-10km) and Very far (> 10km). The proportions of respondents who live Very close (< 1km), Not too far (1-2km) and Moderated (2-5km) are approximately equal, accounting for 27.7%, 28.6%, and 24.1% respectively. 12.5% and 7.1% of interviewees live Relatively far(5-10km) and Very far (> 10km). It can be seen that the majority of interviewees in this study live close to the study area. It can be considered that the people visiting the Shaoxing ancient canal section walkway are mainly

local residents, and the tourism function of the case study area is weak.

5.3.2 Field observation and analysis

①Transportation pattern and activities of respondents

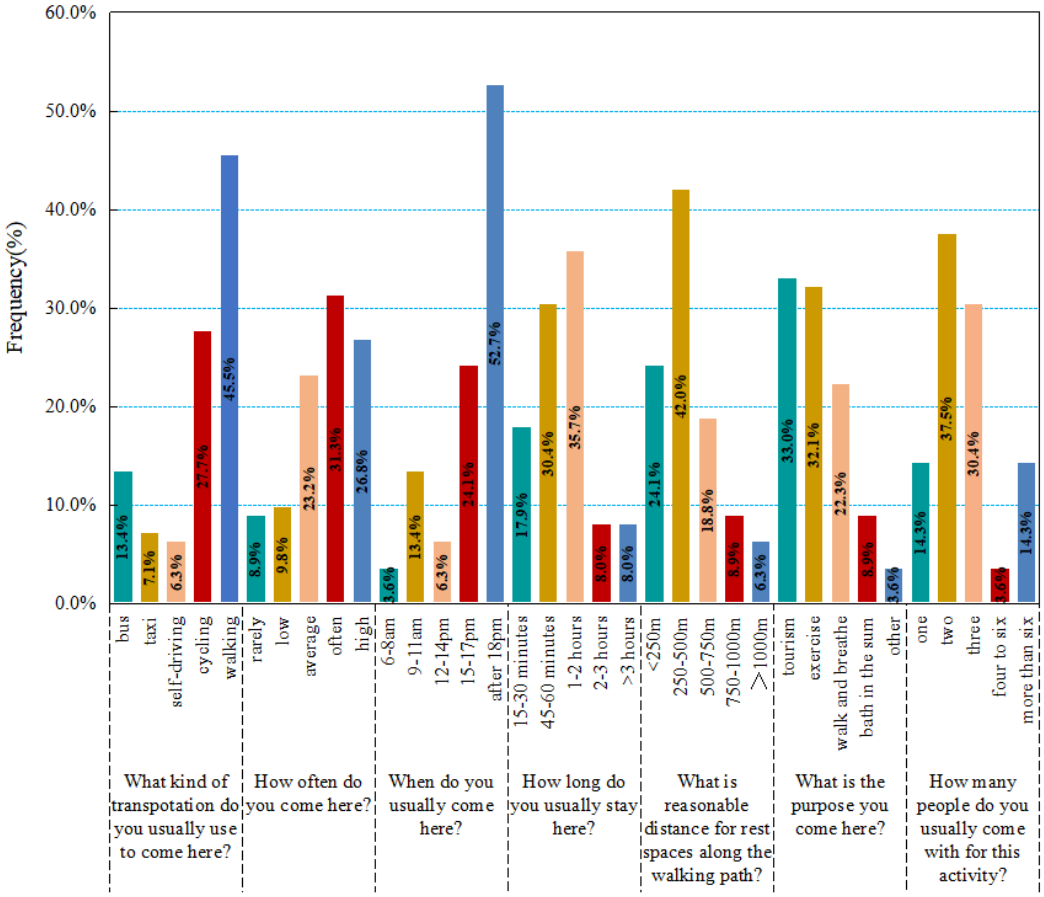

Fig. 5-25 Respondents' behaviors in terms of the way to come and their activities

After collating and analyzing the traffic situation and social behavior of the interviewees, the results are shown in Figure 5-25. Regarding the transportation pattern, 45.5% of the respondents went there by walking, followed by cycling (27.7%), bus (13.4%), taxi (7.1%) and self-driving (6.3%). According to the analysis, there was a significant overlap between people who walked or cycled to the study area (73.2%) and those who lived less than 5km away (80.4%). In terms of frequency of coming here, most people (81.3%) are above average, of who come here with an average frequency accounted for 23.2%, often and high accounted for 31.3% and 26.8% respectively. The proportions of rarely and low are roughly equal, about 8.9% and 9.8%.

Fig. 5-26 Photo collection of Shaoxing Ancient Canal at different times

The analysis of the time of visit showed that more than half (52.7%) respondents chose the time after 18pm, followed by 15-17pm (24.1%) and 9-11am (13.4%). People who chose 12-14 and 6-8 to come here only accounted for 6.3% and 3.6%. In a brief analysis, the interviewees in this study may not have the habit of morning exercises in the study area, but prefer to exercise at night. For

residence time, most people (84%) stayed here in under 2 hours of time, with 17.9% stayed here for 45 to 60 minutes, and 30.4% stayed here for 15 to 30 minutes. 35.7% of interviewees can stay here for 1 to 2 hours, but few of them can stay here for 2-3 hours (8.0%) or more than 3 hours (8.0%). After an analysis of the above data, it can be speculated that there may be no features in the study area that can attract visitors to stay for a long time.

For the setting of the rest space, nearly half of the people (42.0%) suggested that the reasonable distance should be set to 250-500m, while 24.1% thought that the setting below 250m was reasonable. In addition, 18.8% and 8.9% of respondents considered the distances of 750-1000m and 500-750m is reasonable. Only 6.3 percent of respondents supported setting distances above 1,000 meters. People who come here for tourism and take an exercise accounted for 33.0% and 32.1% respectively, followed by those who want to take a walk and breathe fresh air, accounting for 22.3%. People who chose to come here for bathing in the sun accounted for 8.9%, and the remaining persons came for other purposes. More than 80% of the respondents came here with fewer than three people, of which 37.5% were traveling with two people, 30.4% with three people, and 14.3% alone. It is worth mentioning that 14.3% of people travelled with more than 6 people. According to the characteristic of the study area, it can be simple analyzed that compared with developed metropolises, small cities have a slower pace of life and relatively dense crowd contacts. The public has a higher enthusiasm and demand for cultural and recreational activities of small groups such as chess and square dance. Therefore, we can consider a relatively large area of space to meet the needs of the public.

5.3.3 Questionnaire data statistics

①Satisfaction level to the settings of the Shaoxing ancient canal section walkway

This section presents respondents' preference and attitudes towards the components of the Shaoxing ancient canal section walkway in terms of landscape, public service, main facilities, supporting facilities and road functions.

（1）Satisfaction level of landscape

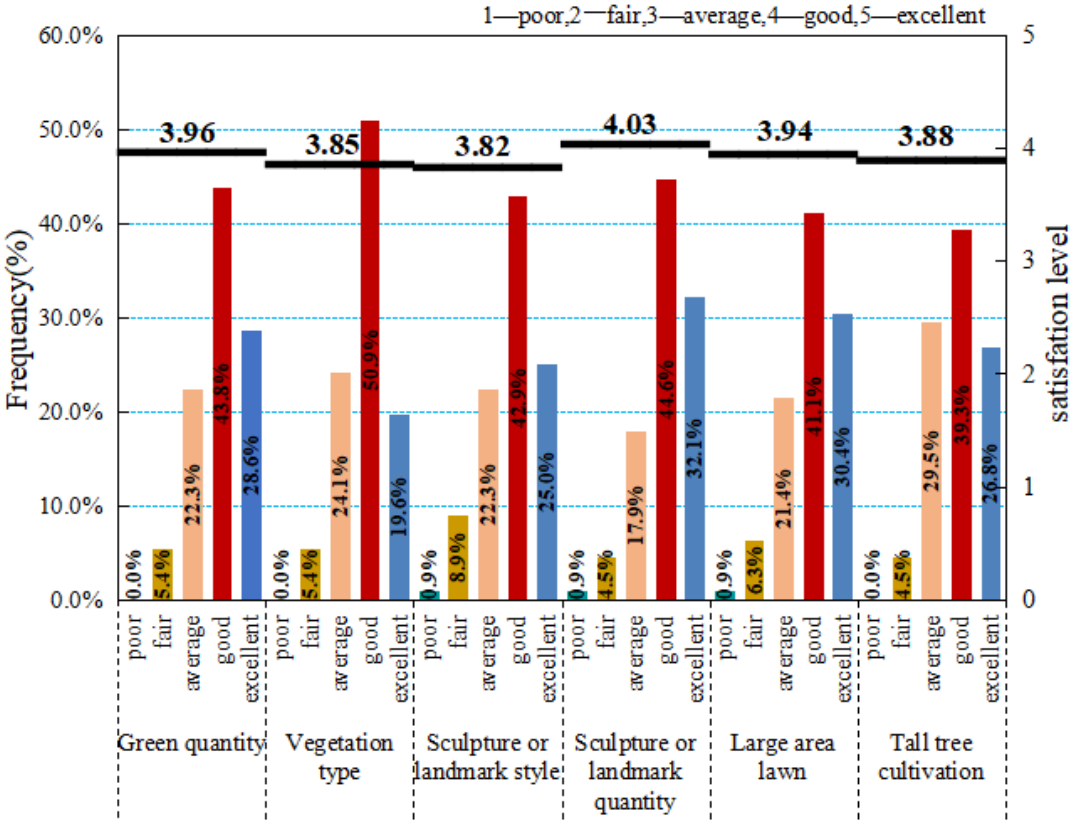

Fig. 5-27 Satisfaction level of landscape among all respondents

After analyzing the questionnaire data obtained from the study, the results are shown in Figure 5-27. The data show that the average satisfaction level of the six surveys of the landscape is about 3.91, which indicates that the respondents have a high level of satisfaction with the landscape construction in the spatial environment. In the six surveys, the highest level of satisfaction was a sculpture or landmark quantity, with a sample mean of 4.03. This was followed by green quantity (3.96), large area lawn (3.94), tall tree cultivation (3.88), vegetation type (3.85) and sculpture or landmark style (3.82). This result indicates that it is necessary to increase the number of sculptures or landmarks in the landscape environment to improve people's satisfaction.

（2） Satisfaction level of public service

Table 5-6 Satisfaction level of public service in terms of rest seat, public bathroom, service kiosk, trash bin, information signs and parking lot

Questions	Frequency of responses (%) (n=336)					Mean	SD	Rank	Sig. (2-tailed)
	1	2	3	4	5				
rest seat (quantity)	0	6.3	25.0	45.5	23.2	3.86	0.84	12	0.000
rest seat(style)	0	1.8	25.9	47.3	25.0	3.96	0.76	7	0.000
public bathroom(quantity)	0	2.7	22.3	38.4	36.6	4.09	0.83	1	0.000
public bathroom(location)	0	5.4	28.6	42.9	23.2	3.84	0.84	13	0.000
public bathroom(style)	0	2.7	30.4	41.9	25.0	3.89	0.81	11	0.000
service kiosk(quantity)	0	3.6	26.8	44.6	25.0	3.91	0.81	10	0.000
service kiosk(location)	0	7.1	28.6	41.1	23.2	3.80	0.88	14	0.000
service kiosk(style)	0	5.4	29.5	33.9	31.2	3.91	0.91	9	0.000
trash bin(quantity)	0	1.8	27.7	36.6	33.9	4.03	0.83	3	0.000
trash bin(location)	0	4.5	17.9	42.9	34.8	4.08	0.84	2	0.000
trash bin(style)	0	2.7	37.5	37.5	22.3	3.79	0.82	15	0.000
information signs(quantity)	0	3.6	25.9	36.6	33.9	4.01	0.87	4	0.000
information signs(clarity)	0	4.5	25.0	39.3	31.2	3.97	0.86	6	0.000
parking lot(bicycle)	0	4.3	25.2	35.6	32.1	3.98	0.88	5	0.000
parking lot(vehicle)	0	2.6	29.5	36.5	28.6	3.94	0.84	8	0.000

Note: 1-poor, 2-fair, 3-average, 4-good, 5-excellent; sig (2-tailed) was obtained based on t-test.

Table 5-6 above shows the respondents' satisfaction with public services. It can be found that the satisfaction levels of the 15 surveys are basically within the range of average and good, as the average scores of 15 aspects all ranged between 3.79 and 4.09. According to the distribution of the data in the chart, the satisfaction levels of the survey on the location and style of public bathroom is not outstanding although the average satisfaction level of the survey on the number of public bathrooms ranks first. Their average scores were only 3.84 and 3.89, ranking 11th and 9th. In addition, the same problem existed in the investigation of the trash bins. The average satisfaction level with the style of trash bin was 3.79, ranking the bottom, while the other two items were both at the top. This phenomenon indicates that in the research area, people have a certain cultural demand for public infrastructure. Therefore, there is a need to improve the design and styling of the infrastructure and services. In addition, the satisfaction level of number and location of rest seats are low, ranking 12th and 7th respectively. This shows that the setting of rest seats in the research area is not reasonable.

（3）Satisfaction level of the main service

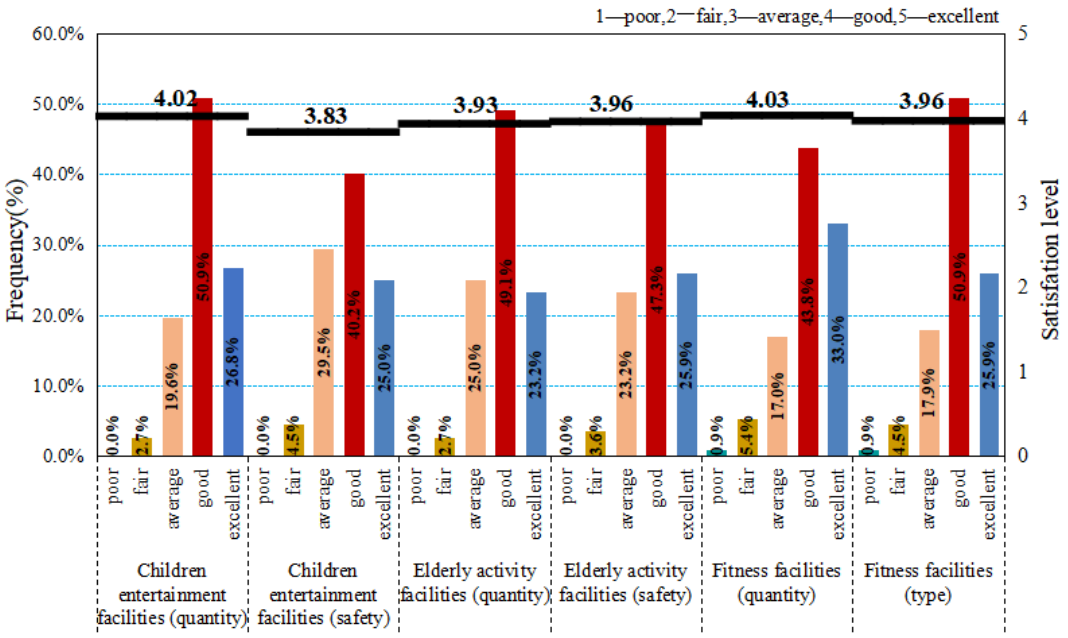

Fig. 5-28 Satisfaction level of the main service among all respondents

Figure 5-28 demonstrates respondents' satisfaction level of this study with the main service, which includes six aspects of children's entertainment facilities (quantity, safety), elderly activity facilities (quantity, safety) and fitness facilities (quantity, type). The overall level of satisfaction ranged from 3.83 to 4.03. This indicates that the main facilities are largely able to meet the needs of the population. There were no significant differences in the six areas. The highest level of satisfaction was for the number of sports and fitness facilities (4.03). The safety of children's play facilities received the lowest satisfaction score (3.83). In combination with the textual comments in the questionnaire, we found that the respondents were not very satisfied with the safety of children's play facilities. Therefore, it is necessary to pay more attention to the safety of children's playgrounds to ensure the safety of the visitors.

（4） Satisfaction level of supporting service

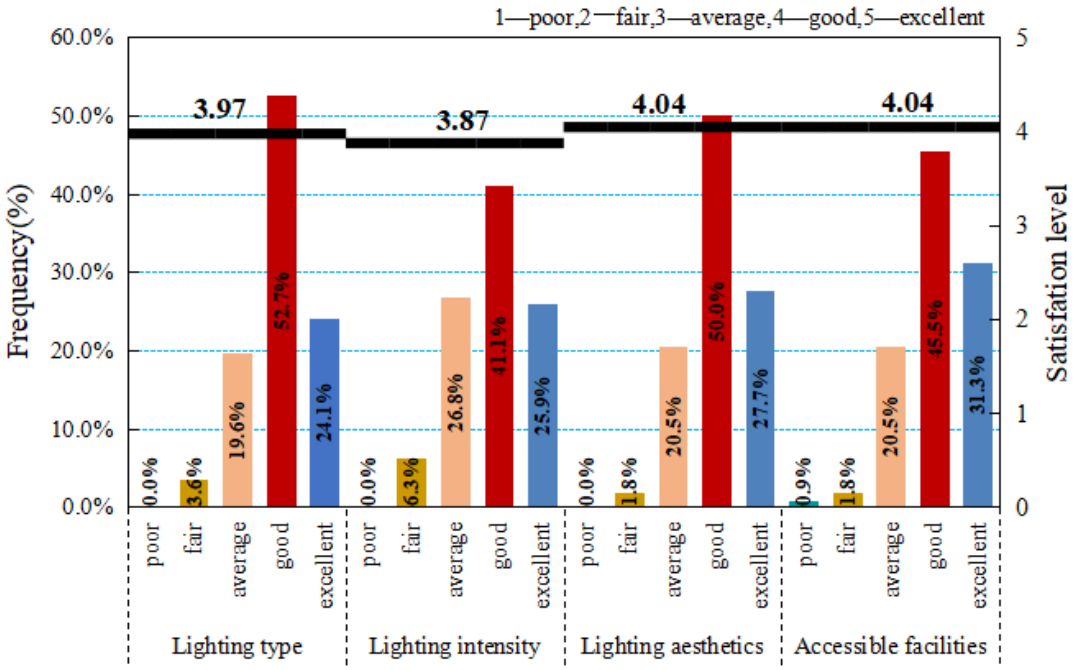

Fig. 5-29 Satisfaction level of supporting service among all respondents

We also conducted some surveys on the supporting services (lighting, accessibility, etc.) in the study area. The results are shown in Figure 5-29.

The analysis of the mean values of the data from the surveys shows that the relative level of satisfaction of lighting aesthetics and accessible facilities is higher, with a mean value of 4.04. The type of lighting fixtures received a satisfaction score of 3.97, which is similar to that of the previous two surveys. The lower level of satisfaction was the intensity of night lighting (3.87). Approximately 33.1% of the respondents considered the satisfaction level of lighting brightness to be below average. This indicates that the night lighting intensity in the study area needs to be upgraded. We have also briefly analyzed the reasons for it. This study was conducted during the summer months, when the weather was hotter and people spent more time outside in the evening. So the demand for lighting brightness of night scene may be higher than in winter. It is suggested to improve the lighting of the canal section according to the activity characteristics of people in different seasons.

（5）Satisfaction level of road functions

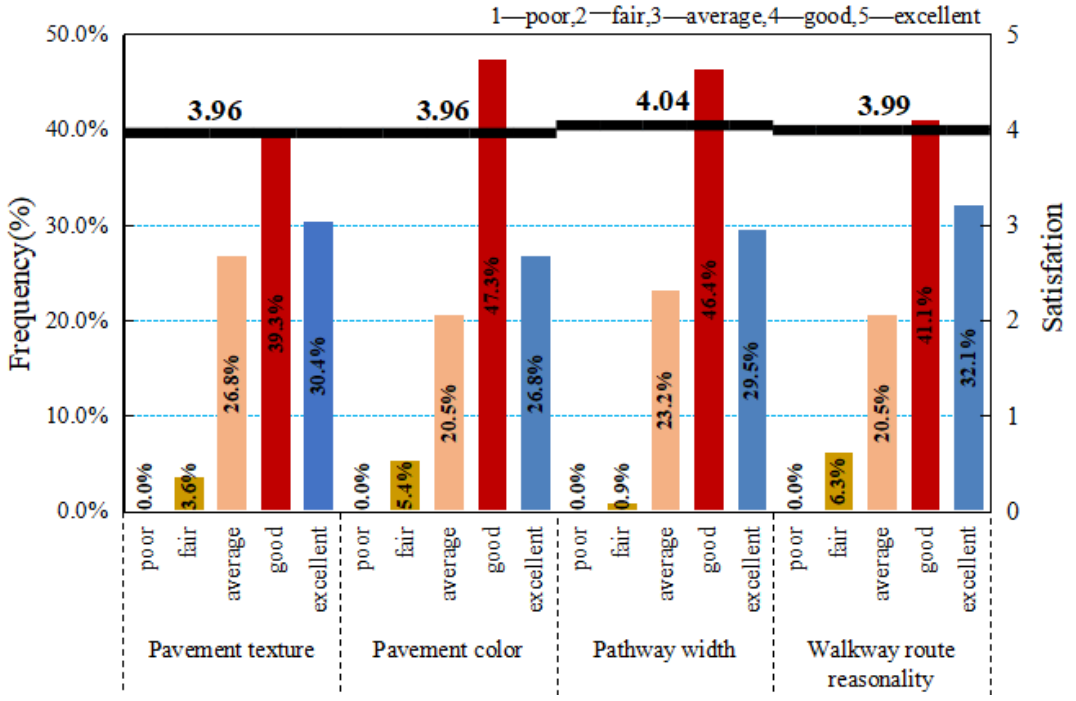

Fig. 5-30 Satisfaction level of road functions

Figure 5-30 shows the level of satisfaction of the respondents with the function of the roads in the study area.

Overall, the level of satisfaction of the respondents with the function of the roads in the study area is high. The mean values for the four areas ranged from 3.96 to 4.04, including pavement texture (3.96), pavement colour (3.96), pavement width (4.04), and walkway route reasonability (3.99). This indicates that the roadway function in the study area is capable of meeting most people's needs.

Although the mean values for each aspect are high, it is worth noting that 6.3% of the respondents considered the reasonableness of walkway route setting in the study area to be fair and 20.5% considered it to be average. A detailed analysis was conducted for this population. The results of the analysis showed that this population visits the study area relatively frequently and stays for longer periods of time. Therefore, it is necessary to consider the opinions of this population for secondary planning and improvement of walkway routes.

②Assessment of the overall quality of the Shaoxing ancient canal section walkway

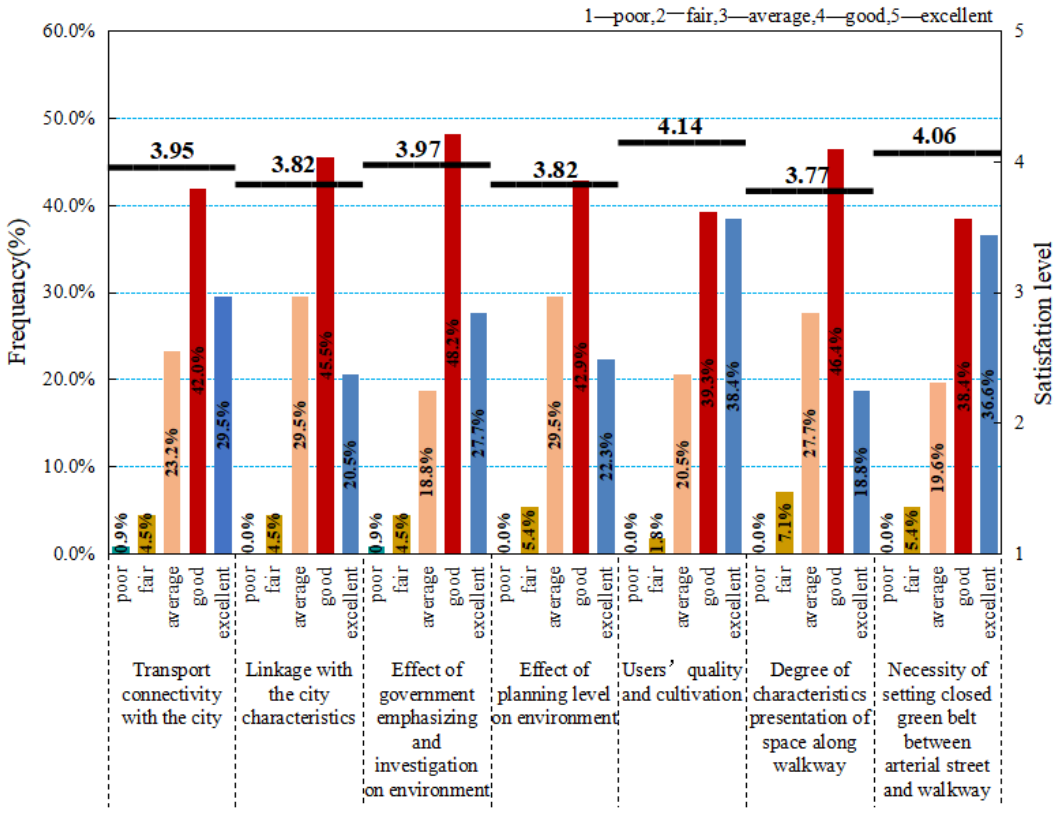

Fig. 5-31 Satisfaction level of overall quality

The interviewees were also invited to evaluate several aspects of the overall quality of the Shaoxing Ancient Canal section. The final results were obtained as shown in Figure 5-31.

The overall quality was investigated in seven main areas, including transport connectivity with the city, linkage with the city characteristics, the effect of government emphasizing and investigation on environment, effect of planning level on environment, users' quality and cultivation, degree of characteristics presentation of space along the walkway, necessity of setting closed green belt between arterial street and walkway. The mean score of the seven surveys reached 3.93, which indicates that respondents generally consider the overall quality of space in the study area to be good. A specific analysis of the charts reveals that respondents generally believe that the quality and cultivation of users have a high impact on the environment, with a mean score of 4.14, ranking first. The mean value of the survey was only 3.77. It means that the people of Shaoxing Ancient Canal are not satisfied with the individuality of the places around the pedestrian zone, and their cultural needs are not met. Therefore, there is a need to improve the space of each place along the pedestrian zone to enrich its cultural characteristics in different directions and improve the quality of cultural life of the people.

③Opinions on the renovation of the Shaoxing ancient canal section walkway

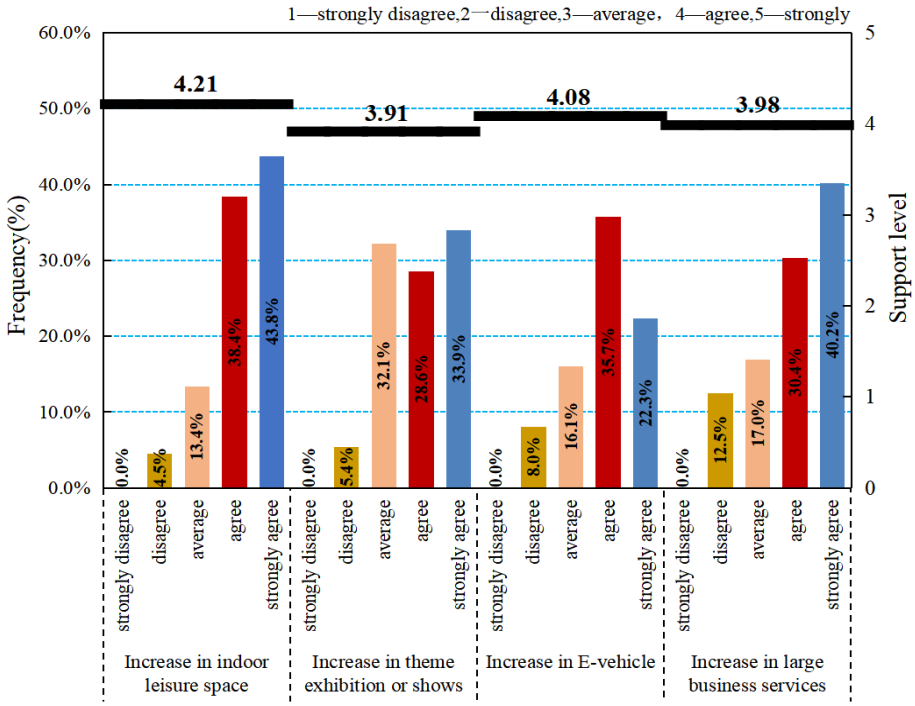

Fig. 5-32 Respondents' opinion on the renovation of Shaoxing ancient canal section walkway

Respondents in this study also evaluated the level of support for the renovation ideas of increase in indoor leisure space, increase in theme exhibition or shows, increase in E-vehicle and increase in large business services. The data results are shown in Figure 5-32.

It was found that the respondents were very supportive of increasing indoor leisure space (4.21), which indicates that indoor leisure space in the study area does not meet the needs of the population. This needs to be improved by increasing the proportion of leisure space in the study area. The support for the addition of E-vehicle (4.08) and large business services (3.98) shows that people have a certain desire for a variety of business activities and the convenience of tourism. The support level of increase in theme exhibition or shows(3.91) is relatively low compared to the other three aspects. It also has certain geographical characteristics. In this study, the residential area near the section of the Shaoxing Ancient Canal was selected as the study area, which has the characteristics of a small river area and relatively narrow surrounding area. There may not have enough venue area to meet the theme exhibition or shows. Therefore, in this survey, the number of respondents (32.1%) who chose the "average" option was more compared with the other three aspects (13.4%, 16.1%, 17.0%).

5.4 Summary

5.4.1 Analysis of Qiantang River survey sample

①Comparison of the satisfaction degree of different categories

The results indicate that different components in the Qiantang riverside walkways exhibit different performance. An overall comparison of different categories in terms of landscape, public service, main service, supporting service and road function is shown in Fig.10. The landscape, supporting service (lighting) and road functions could well meet citizens requirements. This indicates the Qiantang riverside walkway had been well designed to fulfill tourism functions. This could be attractive for the visitors who lived more than 5 km away from the case study area. However, the problem in aspect of the transport linkage with the city (3.84) was a critical problem deterring visitors' feelings for the people who depended on self-driving or cycling. The problem relevant to the transportation was also evidenced by the low satisfaction of respondents in terms of the parking lot (e.g. bicycle, vehicle).

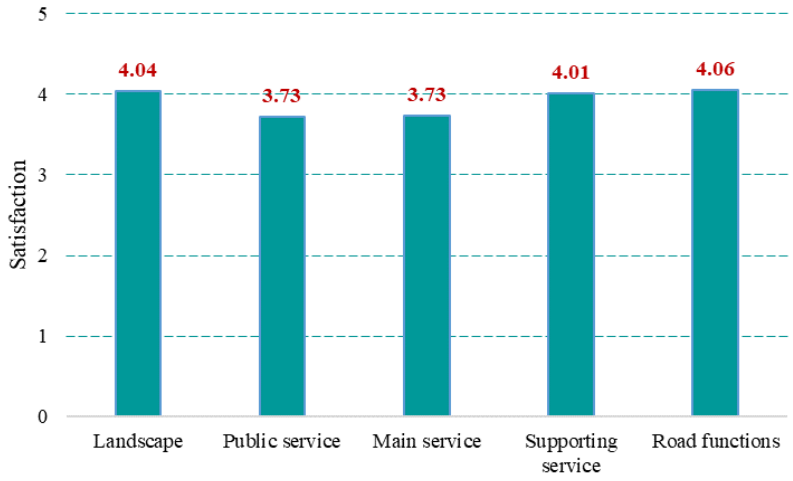

Fig. 5-33 Comparison of the overall satisfaction degree of five categories

In comparison, the public service and main service performed above average level while it could reach a good level. Such results may reflect the Qiantang riverside walkway could not work well on site, not only for visitors who come for tourism but also for local people who come for leisure and entertainment. For the tourists, for example, only the setting of information signs was good to direct them to the right location. Moreover, the tourists may have some specific requirements on the public bathroom, service kiosk, rest seat and parking lot, while such public service could not perform well. This can also be reflected by the people's strong need for indoor leisure space. Moreover, for the local people, they may have a strong reliance on the public service, such as the children

entertainment facilities, elderly activity facilities and fitness facilities, while such service could not reach the good level. The landscape that could meet people's requirements at the 'good' level may result from the increasing efforts to improve the city greenery from the government. Meanwhile, the setting of the sculpture or landmark worked well, while there was still a strong need for the theme exhibition or shows. Moreover, the planning and design of the landscape had made the Qiantang riverside walkway perform well in the linkage with city characteristics and space personality. For the supporting services, people were generally satisfied with the night lighting, especially when most people come after 18:00. The road functions were also good for people's walking, breathing fresh air and exercising. The high satisfaction degree towards the road functions also lowered the requirements in the increase in Vehicle. The function of tourism, leisure and entertainment may also defer the increase in large business service. People were satisfied with the trash bin in terms of quantity, location and style, also corresponding to the results that most people thought the user's quality and cultivation.

②Stratification and agglomeration

In the analysis, the phenomenon of stratification and agglomeration was observed that the same cluster could obtain a similar satisfaction degree. For instance, the quantity and style of rest seat had the satisfaction levels of 6thand 8thand the quantity, location and style of the public bathroom all performed the worst, ranking at 15th, 1 3thand 10thplace. Therefore, a further examination of the phenomenon of stratification and agglomeration was conducted through an independent t-test. The results are shown in Table 5-7. The results further indicate aspects in the same cluster did not exhibit significant differences and evidence the occurrence of stratification and agglomeration. The occurrence of stratification and agglomeration could have significant implications for the planning and design of the Qiantang riverside walkways, as the complexity is caused by the quantity and social requirements (e.g. aesthetic, personal feeling).

Table 5-7 The significance (2-tailed) among similar aspects in the independent t-test

Comparison	Levene's test for equality of variances (sig. (2-tailed))	Significance (2-tailed)	Difference
Greening quantity & vegetation type	0.220	0.749	Insignificant
Sculpture or landmark (quantity & style)	0.644	0.546	Insignificant
Large area lawn & tall tree	0.120	0.941	Insignificant
Rest seat (quantity & style)	0.510	0.942	Insignificant
Public bathroom (quantity & location, location & style, quantity & style)	0.714, 0.369, 0.217	0.846, 0.684, 0.550	Insignificant
Service kiosk (quantity & location, location & style, quantity & style)	0.937, 0.842, 0.788	0.741, 0.892, 0.640	Insignificant
Trash bin (quantity & location, location & style, quantity & style)	0.833, 0.922, 0.769	0.837, 0.947, 0.894	Insignificant
Information signs (quantity & clarity)	0.446	0.717	Insignificant
Parking lot (bicycle & vehicle)	0.308	0.558	Insignificant
Children entertainment facilities (quantity & safety)	0.132	0.892	Insignificant
Elderly activity facilities (quantity & safety)	0.483	0.654	Insignificant
Fitness facilities (quantity & type)	0.920	0.944	Insignificant
Lighting (type & intensity, intensity & aesthetics, type & aesthetics)	0.308, 0.826, 0.413	0.489, 1.000, 0.489	Insignificant
Pavement (texture & colour)	0.691	0.414	Insignificant
Pathway (width & route reasonability)	0.486	0.804	Insignificant

③Implications for the renovation of the Shaoxing ancient canal section walkway

According to the findings in this study, several categories or aspects could not work well to meet the social requirements of respondents. The renovation of the Qiantang riverside walkways was required in several aspects. First of all, it is essential to focus more on public service and the main service to meet the requirement of both tourists and local people. A consideration of public bathroom, service kiosk and parking lots should be the good starts. The increase in indoor leisure space is also required to enable visitors to have more fun here. For the local people, the improvement in the children entertainment facilities, elderly activity facilities and fitness facilities is important. Moreover, people may feel the landscape of the Qiantang riverside walkways monotonous and the increase in the theme exhibition or show may be required to improve the vitality. Second, the transport problems that may restrict tourists'feeling on the Qiantang riverside walkways should be critically addressed in terms of the transportation linkage with the city and the parking lot (e.g. bicycle, vehicle). According to the phenomenon of stratification and agglomeration, during the improvement in the Qiantang River, planners and designers may just merge the consideration of specific aspects into a cluster in order to reduce the complexity. Nevertheless, there should be two further things to consider. The first one is the 'other' purpose people come here, especially when different aspects of urban problems (e.g. air pollution, temperature increase) may occur in the current era. The second one is the questionnaire survey conducted around COVID-19 when many people preferred to stay at home. Therefore, their preferences and attitudes were not included in this

questionnaire survey. Nevertheless, the next-step survey will be conducted after the COVID-19 restriction for comparing whether there are some deviations in the questionnaire survey results. Moreover, the Qiantang riverside walkway is a location for leisure, entertainment and tourism, while the sample for the tourism was limited in the current study. The limited samples may be insufficient in informing the tourism function. Therefore, in the next stage, more samples will be collected to verify the tourism function and further analyze the transport connectivity with the city.

5.4.2Analysis of Beijing-Hangzhou Great Canal survey sample

①Comparison of respondents' satisfaction level of different categories

Figure 5-34 presents respondents' satisfaction level of survey area in five aspects which are landscape, public service facilities, main service facilities, supporting service facilities and road functions. In accordance with Figure 11, there are different qualities in different aspects of survey area. Among all aspects the landscape and road function were scored relatively high which are 4.01 and 4.03 respectively, both are in 'good' level. It demonstrates that survey area has adequate functions to meeting people's leisure and tourism demands. However, main service facilities were scored the lowest 3.73 and in 'medium' level, which indicates that survey area are weak in serving minorities such as kids and the old, and there are not adequate fitness facilities so that the survey area can not meet people's demand in fitness well. Supporting service facilities were evaluated highly which were scored 3.99 and closed to 'good'. It indicates that the lighting in survey area met people's visiting and illumination well, but accessible facilities in survey area need to be upgraded. Public service facilities received 3.89 and are closed to 'good', among all criterion of public service facilities information signs, public bathroom and trash bins satisfied people well, however, parking lots got a poor evaluation which indicates that traffic level of survey area needs to be improved.

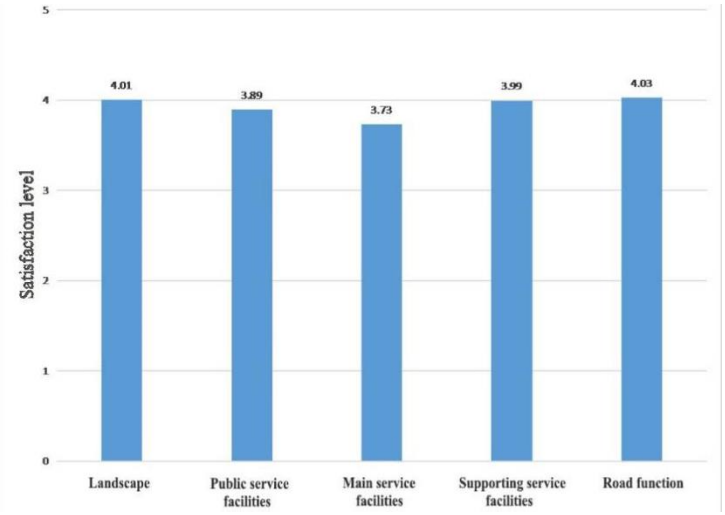

Fig. 5-34 Comparison of the overall satisfaction degree of five categories

Stratification and agglomeration

In this analysis the phenomenon of stratification and agglomeration was observed in the second criterion which belong to one main criterion that could obtain a similar satisfaction level. For instance, quantity and clarity of information sign ranked first and second respectively, but parking lot of bicycle and vehicle ranked 13th and 15th respectively. Hence, further analysis of independent t test is required. The results are shown in Table 8. These results present that there is no significant difference between secondary criterion of one main criterion, and proves the existence of stratification and agglomeration. Further planning and designing will be influenced by exist of phenomenon of stratification and agglomeration because of the complexity of people's demands.

Table 5-8 The significance (2-tailed) among similar aspects in the independent *t*-test

Comparison	Levene's test for equality of variances (sig. (2-tailed))	Significance (2-tailed)	Difference
Greening quantity and vegetation type	0.235	0.604	Insignificant
Sculpture or landmark (quantity & style)	0.347	0.677	Insignificant
Large area lawn and tall tree	0.330	0.618	Insignificant
Rest seat (quantity and style)	0.800	0.855	Insignificant
Public bathroom (quantity and location, location and style, quantity and style)	0.446,0.548,0.873	0.816,0.954,0.862	Insignificant
Service kiosk (quantity and location, location and style, quantity and style)	0.352,0.335,0.997	0.224,0.654,0.431	Insignificant
Trash bin (quantity and location, location and style, quantity and style)	0.391,0.705,0.185	0.723,0.419,0.630	Insignificant
Information signs (quantity and clarity)	0.739	0.947	Insignificant
Parking lot (bicycle and vehicle)	0.307	0.231	Insignificant
Children entertainment facilities (quantity and safety)	0.581	0.383	Insignificant
Elderly activity facilities (quantity and safety)	0.515	0.837	Insignificant
Fitness facilities (quantity and type)	0.886	0.960	Insignificant
Lighting (type and intensity, intensity and aesthetics, type and aesthetics)	0.582,0.323,0.709	0.279,0.742,0.439	Insignificant
Pavement (texture and colour)	0.222	0.849	Insignificant
Pathway (width and route reasonability)	0.714	0.847	Insignificant

Implications for the renovation of the survey area

According to data from this survey, it can be known that there is still some aspects of the survey area need to be optimized. The upgrading of survey area should be carried out in certain aspects. Firstly it should be pursued in traffic facilities, traffic should be better directed, more parking lots should be set and public traffic should be strongly propagandized and encouraged. For the service facilities, quantity and location of the public bathroom can be optimized in order to provide people with better experience, setting more rest seats helps people shift between exercising and leisure freely. Upgrading service kiosk helps people question about information and buy a snack or water. The demands of the vulnerable should be emphasized more in order to improve the safety of the old and kids exercising there. The number of fitness facilities can also be improved so that it will be more convenient for people exercising in survey area.

Indeed, there are 558 respondents in total and this may not reflect the problems of survey area clearly, however, the problems that shown in this survey is also worthy of emphasizing. Questions will be designed more carefully and number of respondents will be increased in later research, in order to present aspects that need to be improved of waterfront area along canal of Hangzhou historical and cultural block.

5.4.3 Analysis of Shaoxing Ancient Canal survey sample

This study conducted a social survey on the spatial behavior of people towards the walkway on both banks of the Shaoxing Ancient Canal in Shaoxing by means of field research and questionnaire survey. The result shows that the respondents have a different social and behavioral requirement for the spatial environment on both sides of the Shaoxing Ancient Canal and that the current walkway on both sides of the Shaoxing Ancient Canal does not meet some of the citizens' demand. Therefore, attention should be paid to related improvements and designs in the subsequent space design and transformation.

①Comparison of the satisfaction degree of different categories

For the overall survey data, we also conducted further analysis. Figure 5-35 shows the overall satisfaction comparison of the five categories.

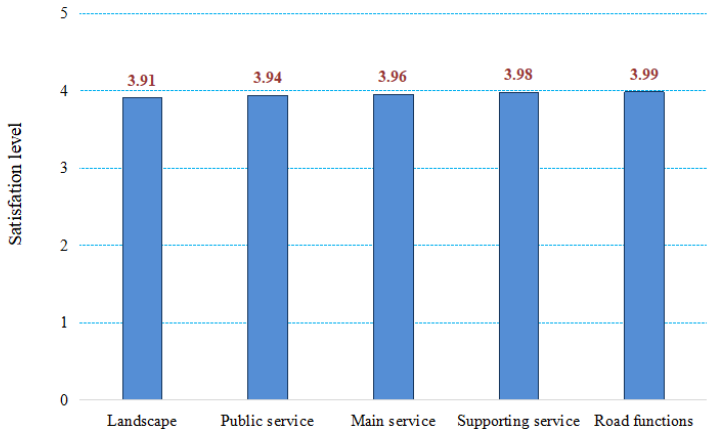

Fig. 5-35 Comparison of the overall satisfaction degree of five categories

As can be seen in Figure 5-35, the investigation of five aspects' service and functions can meet the needs of the public reasonably well. Of these, landscape and public service have a relatively low degrees of satisfaction.

The reason for the low levels of a landscape may be from the comparatively low score of vegetation type and sculpture or landmark style. It implies that respondents have the requirement of culture and spirit for watching and playing in the survey area. Public service's problem is evidenced by not very high levels of satisfaction of public bathroom and service kiosk. These two problems are reflected in many aspects, such as the location, quantity, etc.

According to the basic information of the interviewees, we can see that most of the visitors live close. So the demand for convenient transportation is relatively low. This leads to a high level of satisfaction with road function. Most people visit for play and rest. Therefore, the requirements for

public services and other supporting service facilities are high. This not only reflects the shortcomings of regional construction and design but also provides a theoretical basis for further renovation.

②Stratification and agglomeration

Table 5-9 The significance (2-tailed) among similar aspects in the independent t-test

Comparison	Levene's test for equality of variances	Significance (2-tailed)	Difference
Greening quantity and vegetation type	0.688	0.332	Insignificant
Sculpture or landmark (quantity & style)	0.142	0.092	Insignificant
Large area lawn and tall tree	0.921	0.653	Insignificant
Rest seat (quantity and style)	0.167	0.363	Insignificant
Public bathroom (quantity and location,location and style, quantity and style)	0.882; 0.616; 0.723	0.027; 0.628; 0.075	Insignificant
Service kiosk (quantity and location,location and style, quantity and style)	0.176; 0.719; 0.091	0.344; 0.370; 1.000	Insignificant
Trash bin (quantity and location, location and style, quantity and style)	0.775; 0.430; 0.613	0.632; 0.011; 0.036	Insignificant
Information signs (quantity and clarity)	0.894	0.757	Insignificant
Parking lot (bicycle and vehicle)	0.858	0.698	Insignificant
Children entertainment facilities (quantity and safety)	0.027	0.157	Insignificant
Elderly activity facilities (quantity and safety)	0.825	0.798	Insignificant
Fitness facilities (quantity and type)	0.393	0.590	Insignificant
Lighting (type and intensity, intensity and aesthetics,type and aesthetics)	0.017; 0.020; 0.884	0.330; 0.120; 0.537	Insignificant
Pavement (texture and colour)	0.457	0.937	Insignificant
Pathway (width and route reasonability)	0.204	0.626	Insignificant

The phenomenon of stratification and agglomeration is also found in this investigation. For example, th quantity, location and style of service kiosk had the satisfaction levels of 10th,14th and 9th, respectively. Therefore, we conducted a further examination of stratification and agglomeration through the independent t-test. The results are shown in Table 9. The results further indicate that there is no significant difference in the same cluster. So we can think that stratification and aggregation exist.

According to the specific characteristics of stratification and agglomeration, we can adjust the planning and design of urban waterfront space to meet the general needs of the people.

③Implications for the renovation of the Shaoxing ancient canal section walkway

By analyzing the social needs of the interviewees as a whole, we can get some implications for the renovation of the Shaoxing ancient canal section walkway. First of all, for landscape and public services, consideration needs to be given to improving vegetation type and the style of sculpture or landmark to meet the visitors' cultural needs for waterfront space. For infrastructure improvements, we can pay attention to improving the safety of children's entertainment facilities and lighting intensity. In addition, the number and style of rest seats, indoor leisure space also urgently need to be increased or improved. It is worth mentioning that due to the impact of the COVID-19, the number of samples obtained in this survey is relatively small, and most of them come from surveys. So the data obtained may be biased.

Reference

[1]Yanza Yuan, Design in Design [M], Jinan: Shandong People's Publishing House.

[2] Zhimin Li,Yan Wang. Built Space Environment and Behavior [M], Wuhan: Huazhong University of Science and Technology Press, 2009.

[3] Hao Zhang , et al. An Empirical Study of Geographical Features in Urban Park Design [J], Journal of Tianjin Urban Construction College,2007,6:88-96.

[4] Huawen Yang , Xiaofeng Cai. Lessons Learned from Urban Landscape Preservation Experiences. Urban Planning International,2005,6:62-64.

[5]Tingting Jiang, A Study of Landscape Design Based on Sensory Experience (Master's Thesis), Nanjing: Nanjing Art Institute, 2014.4.

[6] Martin Ashton. Translated by Wengui Ji. Landscape Masterpieces Collection. Nanjing: Jiangsu Science and Technology Press, 2003.

[7] Bo Liang. Industrial Heritage of Japan [J], Journal of Harbin Institute of Technology,2008,3:9-17.

[8] Ying Zhai. Study on Optimization of Land Use Structure Based on the Concept of Industry-City Integration: Yangzhong City as an Example [D]. Nanjing Normal University,2015.

[9] Laura E. Ferguson. A negotiated landscape: the transformation of San Francisco's waterfront since 1950. 2012, 27(4):659-660.

[10] Jason Henderson. A Negotiated Landscape: The Transformation of San Francisco's Waterfront Since 1950. Jasper Rubin. 2012, 33(5):756-758.

[11] Wei Wu. Urban Character: Historic Landscapes and Waterfronts (Theory and Practice of Historic Environmental Protection) [M], Tongji University Press, 2009:211-218.

[12] Lin Zhu, Shao Ping Guan. Ecological Assessment of University Campus' Waterfront Landscape: With Guangzhou Higher Education Mega Center as a Case. 2018, 167(1).

[13] Jay Mittal, Sweta Byahut. Value Capitalization Effects of Golf Courses, Waterfronts, Parks, Open Spaces, and Green Landscapes — A Cross-Disciplinary Review. 2016, 8(1):62-94.

[14]Cheng Chen. Shanghai Huangpu River Water Tourism Industry Chain Analysis Study [D] Shanghai: Fudan University, Master's Thesis, 2012.

[15] Carlos Renzo Zeballos Velarde and Keita Yamaguchi. Conception of Japanese Urban Waterfronts: The Formation of Ōtsu in Relation to Lake Biwa's Landscape. 2016, 3(3).

[16] Stephen Nepa. A History of Brooklyn Bridge Park: How a Community Reclaimed and Transformed New York City's Waterfront eds. by Nancy Webster and David Shirley, and: Central Park Trees and Landscapes: A Guide to New York City's Masterpiece eds. by Edward Sibley Barnard and Neil Calvanese (review). 2018, 99(1):121-126.

[17] Liang Sun, Hua Shao, Shuyang Li, et al. Integrated Application of Eye Movement Analysis and Beauty Estimation in the Visual Landscape Quality Estimation of Urban Waterfront Park. 2018, 32(9).

[18] Carlo Johnson. I Urban landscape design in waterfront areas [A]. International Federation of Landscape Architects, Chinese Society of Landscape Architecture, Jiangsu Provincial Department of Construction, Wuxi Municipal People's Government.2007 International Conference on Landscape Architecture [C]. International Federation of Landscape Architects, Chinese Society of

Landscape Architecture, Jiangsu Provincial Department of Construction, Wuxi Municipal People's Government: Chinese Society of Landscape Architecture,2007:5.

[19] Yasuhiko Wada, Yasuhiro Miki, Taira Ozaki. Valuation of Waterfriont Spaces Bult Using Treated Wastewater. 2006, 34:569-574.

[20] Kim Ga Ya, Yoon Sang Bok, Kim Jung Ho. The Estimation of the Waterfront Residential Environment. 2005, 14(2):129-139.

[21] Ming Du, Yun Zhang. The Organic Evolution of Chinese Traditional Urban Waterfronts: A Case Study of the Landscape of Slender West Lake. 2013, 2331:2788-2791.

[22] Li Yang, Cong Ling Meng. Analysis on the Urban Space Design of Small and Medium-Sized City at both Banks of Waterfront - Take Urban Space Design of the City at both Banks of Waterfront at Heshun County Town as Example. 2013, 2203:2765-2769.

Chapter 6

COMPARISON ANALYSIS OF VISUAL LANDSCAPE IMAGE FACTORS IN SAMPLES

CHAPTER SIX: COMPARISON ANALYSIS OF VISUAL LANDSCAPE IMAGE FACTORS IN SAMPLES

6.1 Visual landscape image

Visual landscape image is based on the requirements of human visual image experience, according to the aesthetic law, the use of space physical scenery, the study on how to create a pleasant environmental image, to emphasize that the landscape environment image first needs a bright visual image[1]. It together with environmental greening and public behavior psychology constitute three yuan of modern landscape planning and design.

In the survey of waterfront landscape space, the questionnaire analyzed the mean value and standard deviation of the three blocks from nine aspects including the amount of greenery, plant species, number of sculptures, sculptural modeling, landscape lawn, tall trees, lighting collocation, night scene brightness and lighting effect. The analysis results are as follows:

Table. 6-1 Descriptive statistics of visual landscape within three areas

Category	Item	Hangzhou waterfront space	Hangzhou section of the Canal	Shaoxing section of the Canal
Green quanlity	Average	4.0980	4.0914	3.9554
	SD	0.89564	0.81687	0.85306
Vegetation type	Average	4.0588	4.0484	3.8482
	SD	0.85392	0.78004	0.79650
Sculpture quantity	Average	4.0490	3.9247	3.8214
	SD	0.90518	0.86038	0.94167
Sculpture style	Average	3.9706	3.8871	4.0268
	SD	0.94874	0.87805	0.87467
Scenery lawn	Average	4.1176	4.0484	3.9375
	SD	0.93654	0.90214	0.92299
Tall tree	Average	4.1471	4.0323	3.8839
	SD	0.82531	0.79799	0.85683
Lighting type	Average	3.9608	4.0161	3.9732
	SD	0.94315	0.82839	0.76476
Lighting intensity	Average	4.0490	4.1075	3.8661
	SD	0.87175	0.79814	0.87503
Lighting aesthetics	Average	4.0490	4.0806	4.0357
	SD	0.87175	0.77735	0.74651

In terms of the amount of greening, the standard deviation of Hangzhou waterfront waterfront landscape area is the largest, 0.895, which proves that people have different opinions on the amount of greening in this area, and the difference in the understanding of the amount of greening directly affects the landscape recognition degree of people in this area. The minimum standard deviation value of Hangzhou section of the Canal waterfront landscape area is 0.816. People are satisfied with the amount of greening in this area, and their opinions are relatively consistent. When the amount of greening meets people's needs, a natural space will be created that is significantly different from

the hard space in the city, attracting more people to enter the space. The standard deviation of Shaoxing section of the Canal reach is in the middle value, 0.853, which indicates that people are moderately satisfied with the amount of greening in this area, which may also reflect insufficient attention to the amount of greening in this area.

In plant species, the largest standard deviation values of Hangzhou waterfront landscape area, is 0.853, that opinion of plant species in the area differences, there are many different people's choice of plant species, also proved that the people of the diversity of waterfront plants need, and comprehensive demands within the space activities of plant species diversity; Hangzhou canal waterfront landscape area and the standard deviation value is more close to the ancient canal area, Shaoxing is lower than Hangzhou waterfront landscape area, 0.780 and 0.796, respectively, reflecting the ancient canal along the coast of waterfront space, the kinds of plants grow significantly more rich, ecological environment than the new waterfront space more stable, more suitable for biological derivative development, and the ancient canal along with more ancient trees, plant growth cycle is long, for the urban waterfront space environment added a natural color.

Fig. 6-1 Photos of sculpture in Hangzhou Canal section(left) ,sculpture in Shaoxing Ancient Canal section(right)

In the number of sculpture, Shaoxing difference value of 0.941, the ancient canal is maximum number of three areas, to prove the public sculpture for Shaoxing ancient canal section number satisfaction is low, Shaoxing as contains the cultural history of the ancient canal water system, in the surrounding of waterfront space shape, should focus on reflect the culture and history of space, not only on the space form, more can be reflected in the sculpture, let people always feel the canal culture, increase the canal waterfront space experience; Hangzhou Binjiang section’s waterfront landscape space standard deviation is 0.905, the number of the sculpture shows that people in the space area there are differentiation and the number of sculpture is to satisfy the masses, more think to promote the masses, to a certain extent, also reflects the landscape space in Hangzhou Binjiang section’s waterfront space, to extract the characteristics of cultural remains to be improved, can the

space characteristics and cultural transformation, by means of visual landscape sculpture is used to reflect; Sculpture in Hangzhou Binjiang section's waterfront space in the number of standard deviation was 0.860, shows that people of Hangzhou section of the Canal section of the satisfaction is higher, the number of sculpture in Hangzhou Binjiang section's waterfront space, have more description canal culture is a historical chronicle of landscape sculpture, sculptures can help people just experience the historical situation at that time, in the waterfront space is more the sense of 'feel the canal culture unique charm.

Among the sculptures, the standard deviation of Binjiang section in Hangzhou is the highest, reaching 0.948, which indicates that people have obvious judgment differences on the sculpture of Binjiang district, with different praise and criticism. To some extent, it also reflects that the existing culture in the space is not fully reflected and the audience cannot smoothly perceive it. In the waterfront space of Hangzhou Canal reach and Shaoxing ancient Canal reach, the standard deviation value of sculpture modeling is 0.878 and 0.874 respectively, indicating a high degree of satisfaction with sculpture modeling. Sculpture modeling can bring characteristic landscape experience to the space environment by relying on canal culture, and increase the cultural atmosphere of waterfront space.

In landscape lawn, the three areas of waterfront space standard deviation value is smaller, Hangzhou Binjiang segment is 0.936, respectively, Hangzhou section of the canal is 0.902, Shaoxing section of the ancient canal is 0.922, the difference value is small, the landscape lawn satisfaction is relatively uniform, may also reflected the different cultural differences, because different from European countries, in China, the main functions of the landscape lawn more embodies in green ornamental, few people will go to use landscape or trample the lawn, so people to the lawn for landscape evaluation standard is more consistent.

Among the tall trees, the standard deviation of the waterfront landscape space in Hangzhou Binjiang section and that in Shaoxing ancient canal section is close, 0.825 and 0.856 respectively, and the standard deviation of Hangzhou canal section is lower, 0.797. Tall trees in Binjiang, the role of landscape space is mainly manifested in the space division, in the field of tall trees in the landscape space easily as the center of the crowd gathering, "enjoy the cool shade" is this truth, the tall trees in the outdoor space will bring more security to the person, is the main symbol of gathering space, three area more similar opinion of tall trees.

In terms of lighting collocation, the waterfront space of the three regions presents great differences. In the waterfront landscape space of Hangzhou Binjiang section, the standard deviation value of lighting collocation is 0.943, 0.828 for Hangzhou canal section, and 0.764 for Shaoxing Ancient Canal section. Visible in the lamps and lanterns collocation in Hangzhou Binjiang segments

greater differences of opinion, lamps and lanterns collocation is relatively single, can't meet the demand of more than put the landscape lighting, or the field of landscape lamps and lanterns collocation can't reflect the vitality of culture, has great room to improve, in Hangzhou canal section in the opinion of lamps and lanterns collocation are relatively unified and canal section populated places as tourist activities, and on the collocation of lamps and lanterns can basically meet the needs of tourists and residents; Shaoxing ancient canal has the smallest difference of opinion. On the one hand, it can be considered that people have uniform requirements for lamps from the aspect of space environment; on the other hand, it can also be judged from the main positioning of space activities in the site.

In nighttime brightness, Hangzhou Binjiang segments and Shaoxing waterfront space is larger, the difference of the ancient canal are 0.871 and 0.875 respectively, the main service object of this two places a crowd of residents, pay more attention to in using the universal standardization, and Hangzhou canal zone as a definite plus comprehensive tourism space, on the night lights brightness in addition to focus on practical lighting pay more attention to the cultural atmosphere of the build at night, the standard deviation value is lower, at 0.798, opinion of the light is relatively uniform.

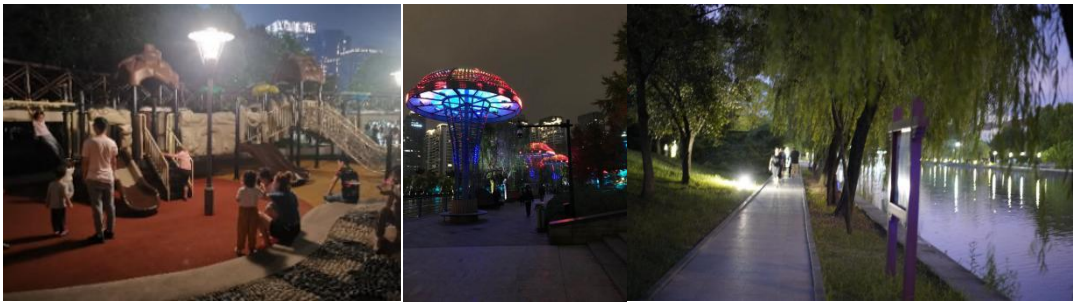

Fig. 6-2 Photos of nighttime lighting in Hangzhou waterfront space(left) ,nighttime lighting in Hangzhou Canal section(middle) ,nighttime lighting in Shaoxing Ancient Canal section(right)

Among the lighting effects, the standard deviation of the waterfront space in Hangzhou Binjiang section is the largest, 0.871. Opinions differ greatly on the lighting effects. It is believed that there is a large space for improving the lighting effects in the landscape space, and it can be combined with the Qiantang River culture basin to form the landscape lighting effects that echo the culture. Secondly, the standard deviation of lighting effect in Hangzhou section of the Canal is 0.777, which indicates that the existing lighting effect has satisfied the needs of crowd activities and tourists' cultural experience. The standard deviation of Shaoxing Ancient Canal section is 0.746, which reflects that people are satisfied with the current lighting effect, and the tourism development in this area is relatively low, so the lighting effect is relatively simple.

6.2 Service facilities

Any space should be a service-oriented space in the first place. Only when the space and crowd demand reach a balance between supply and demand can they attract each other, so is the waterfront landscape space. In the the course of the research, we aimed at service facilities is evaluated in three area, from the number of seats, seat modelling, number of toilet, toilet, toilet location, number of stand, stand, stand, bin location, number of trash can, trash can shape, plate number, clarity, deposit, mobile parking the 15 aspects, service facilities for analysis of space crowd's satisfaction, the results are as follows:

Table 6-2 Description statistics of service facilities within three areas

Category	Item	Hangzhou waterfront space	Hangzhou section of the Canal	Shaoxing section of the Canal
Seats quantity	Average	2.9608	3.8763	3.8571
	SD	1.09835	0.96466	0.84744
Seats style	Average	2.9510	3.8280	3.9554
	SD	1.09343	0.90193	0.76392
Toilet quantity	Average	3.6078	3.9032	4.0893
	SD	1.00648	0.89521	0.83346
Toilet location	Average	3.6765	3.9247	3.8393
	SD	0.96638	0.88515	0.84420
Toilet style	Average	3.7353	3.9194	3.8929
	SD	0.94320	0.89379	0.80937
Kiosk quantity	Average	3.8627	3.9355	3.9107
	SD	0.91239	0.93354	0.81156
Kiosk location	Average	3.8235	3.8172	3.8036
	SD	0.90556	0.94092	0.87857
Kiosk style	Average	3.6471	3.8602	3.9107
	SD	1.01129	0.90752	0.90597
Trash bin location	Average	3.5686	3.9409	4.0268
	SD	1.27045	0.83940	0.83245
Trash bin quantity	Average	3.6176	3.9731	4.0804
	SD	1.19441	0.91494	0.83976
Trash bin style	Average	3.6275	3.8978	3.7946
	SD	1.28911	0.87937	0.81802
Information signs quantity	Average	3.6471	4.0000	4.0089
	SD	1.17437	0.77110	0.86468
Information signs clarity	Average	3.6078	4.0054	3.9732
	SD	1.25987	0.78841	0.86431
Bicycle parking lot	Average	3.5882	3.8172	3.9821
	SD	1.07494	0.92936	0.88003
Car parking lot	Average	3.5882	3.6989	3.9375
	SD	1.09321	0.97299	0.84129

In terms of the number of seats, the number of standard deviations in the waterfront landscape space of Hangzhou Binjiang section reached 1.098. It can also be proved that the number of seats in the waterfront landscape space of Hangzhou Binjiang section is set in an uneven position. Unable to provide seating service for people in a timely manner, thus resulting in dissatisfaction with the number of seats. In Hangzhou canal section, the standard deviation value of seats reaches 0.964, which can be analyzed from two aspects. First of all, Hangzhou Canal section, as the main tourist area, will have a larger flow of people than the living area and a higher demand for seats. Secondly, in the canal section of Hangzhou, the activity amount of the crowd is relatively dispersed throughout the day, and there is crowd flow in each time period, so there is randomness in the satisfaction of the number of seats. In the ancient Canal section of Shaoxing, the standard deviation of the number of seats is 0.847. Compared with the three regions, Shaoxing Ancient Canal section has a more unified opinion on the number of seats, because the tourism development in this area is still insufficient, the activity amount of people is less, and the activity population is mostly local residents, who are familiar with the space environment, the number and distribution of seats, so the satisfaction level of seats is improved accordingly.

Fig. 6-3 Photos of Chair style in Hangzhou Canal section(left) ,chair style in Shaoxing Ancient Canal section (right)

In terms of seat modeling, the standard deviation value of Hangzhou Binjiang section is the highest, 1.093, which proves that there is a big difference in people's satisfaction with seat modeling in the waterfront landscape space of Hangzhou Binjiang section. The water system in Hangzhou's Binjiang section is Qiantang River. In the waterfront landscape space, the seat shape can be designed according to the water system culture, which can not only meet the seat demand but also reflect the unique water culture of the waterfront space, and people's acceptance will also be improved accordingly. In Hangzhou canal section, the standard deviation of seat modeling was 0.901, which was located at the median level of the three regions. It shows that the seat modeling in this area basically meets people's aesthetic evaluation. Both residents and tourists are provided with relatively

satisfactory seat modeling design, so that residents can perceive local culture in the space and tourists can experience characteristic culture during the tour. However, there may still be differences between cultural identities of individuals, so this value is in the middle of the higher value. In Shaoxing ancient canal section, the standard deviation of seat modeling is 0.763. Is the lowest value in the three areas, indicating that people's satisfaction with the seat modeling in the space is relatively uniform. To some extent, it also indicates that the local residents in this area occupy a large proportion of the active population, and the demand for seat modeling is low. More from function practical start, so the attention to the appearance of the existence of neglect.

In the survey of the number of toilets, the standard deviation value of waterfront space in Hangzhou Binjiang section is the highest, which is 1.006, indicating that people's opinions on the number of toilets in this area are not uniform. Hangzhou Binjiang segments as main service space, residents live in a period of time space traffic statistics we can see that most people choose to travel in the evening, after the evening crowd activity will surge, the demand for the toilet will surge in a short time, which led to a number for the toilet feel more satisfaction. In view of the above problems, appropriate diversion strategies can be made in the space, and at the same time, portable toilets can be added to areas with dense crowd activities to alleviate people's needs. The standard deviation of the number of toilets in Hangzhou canal section is 0.895, which is the median level of the three regions. This indicates that people in this area are satisfied with the supply and demand of the number of toilets. As a public tourism space, Hangzhou canal section not only has a high standard for public toilets, but also provides toilets for the surrounding public buildings, so the quantity basically meets the needs of people. In the ancient Canal section of Shaoxing, the standard deviation of the number of toilets was 0.833, which was the lowest among the three regions, indicating that people in the region were satisfied with the number of toilets, which could basically reach the balance between supply and demand.

In the survey and analysis of toilet location, the standard deviation of Hangzhou Binjiang section is 0.966, which is the highest value among the three regions, proving that people have different opinions on the distribution of toilet location in this region. It may be inconvenient for people to move around in space. Therefore, when setting the location of the toilet, the dense space of the crowd should be considered first; Secondly, toilets and signs should be set in the passageway or distinguishable obvious location to provide the most convenient service for the crowd in the shortest time. The standard deviation of the toilet location in Hangzhou Canal and Shaoxing Ancient Canal is similar, 0.885 and 0.844, respectively. Although the spatial attributes and development positioning of the two sections are different, they are both integrated Spaces for living and tourism. The spatial tourism development of Hangzhou canal section is relatively mature, and the toilet location is relatively reasonable. Tourism development in Shaoxing Canal section is still relatively slow, and

most of the people who move in the space are local residents, and their familiarity with the space also improves the satisfaction degree of the toilet location.

In the survey of toilet modeling, the standard deviation of toilet modeling in Binjiang section of Hangzhou is 0.943, which is still the highest value in the three regions, proving that people believe that there is a large room for improvement in toilet modeling. As one of the main structures in the waterfront space, the toilet can be designed according to the culture within the area. Including building materials, building structure and the overall style of the building, should be closely related to the culture reflected by the space, so that people can reach the highest degree of recognition in the fastest time. In Hangzhou canal section, the standard deviation of the satisfaction degree of the toilet shape is 0.893, which is the median level of the three regions. Hangzhou canal section tourism development has been relatively mature. Therefore, the design of the toilet shape, from the material, structure and style can be more in line with the cultural style of the canal section, can be generally accepted by the crowd. In Shaoxing ancient Canal section, the standard slag value of toilet shape is 0.809. People's opinions on toilet shape are relatively unified, which may also indicate that people pay less attention to toilet shape.

In the survey on the number of kiosks, the standard deviation of Hangzhou canal section is 0.933, the highest value in the three regions, which proves that people have different opinions on the number of kiosks in this region. Hangzhou canal section of clusters as a tourist area, on the stand quantity may exist in the trend of surplus, the population reasonable stand in space can be timely to provide convenient service for people, but when selling booth number too much, will give the feeling of commercial atmosphere can too thick, can form a kind of oppressive feeling, is not conducive to the experience of the space. Therefore, the number of kiosks in the area can be controlled to some extent, or the content of kiosks can be changed, which can reflect the unique water culture of the space and at the same time achieve the basic function of selling. At intermediate values are Hangzhou Binjiang segments and the standard deviation value of 0.912, shows that people in the area to sell booth number of advice are relatively uniform, but there is some room for improvement, the number of service kiosk set in the space, can to a certain extent, improve the space vitality, from the Angle of commercial house, bring more people to the space. In the ancient Canal section of Shaoxing, the standard deviation of the number of Meting is 0.811, which is the lowest standard deviation in the three regions. It proves that people's opinions on the quantity of Metene in the region are relatively unified.

In the statistics of booth locations, the standard deviation of Hangzhou canal section reached the highest value, 0.940. This shows that people have different opinions on the location of kiosks in Hangzhou Canal section. Reasonable kiosks can bring people a bright scenery in time when they

experience the space, and can solve people's urgent need. The unreasonable location of kiosks will bring more negative emotions to people and affect their experience of space. In the Binjiang section of Hangzhou, the standard deviation of the kiosk location is 0.905, which is in the middle of the three regions, proving that the kiosk in this region can timely provide services for people. In the ancient Canal section of Shaoxing, the standard deviation is 0.878, which is the lowest value in the three regions, proving that people's satisfaction with the location of the kiosk is relatively uniform.

The standard deviation of Hangzhou Binjiang section is the highest, 1.011. This indicates that people in this area have different opinions on the shape of the kiosk. The kiosk is the same as the open test. As an obvious structure in the space, its shape should be similar to the culture and style reflected in the space to form unity. In the process of selling services, culture is also contained in the whole process, achieving a kind of hidden communication. The standard deviation values of Hangzhou canal section and Shaoxing Ancient Canal are close, 0.907 and 0.905, respectively. It shows that in these two areas, the design of the kiosks is unified, which can be combined with the culture of the ancient canal to design the kiosks, which can reflect the unique local water culture style, and the sales process can also experience the cultural attributes it conveys.

In the survey of trash bin location, the standard deviation value in the waterfront landscape space of Hangzhou Binjiang section reached 1.270, which was obviously higher than the other two areas. This indicates that people have different opinions on the location of garbage cans in this area. To some extent, such a value is also due to the stricter implementation of garbage classification management, so the setting of garbage can location is more standardized, which may lead to inadaptability of people in a short period of time, resulting in large differences of opinion. The standard deviation of Hangzhou canal section and Shaoxing Ancient Canal section is similar and lower, 0.839 and 0.832, respectively. These two Spaces serve as main Spaces for tourism. The location standard of its garbage can will also be different from that of residential space, which can basically meet people's satisfaction standard.

In the survey of the number of garbage cans, the Binjiang section in Hangzhou still has the highest value, with a standard deviation of 1.194. This indicates that people have different opinions on the number of garbage cans in this area, and the reduction of the number of garbage cans is also affected by garbage classification to a certain extent, which may bring discomfort to people in a short period of time, resulting in this high value. The standard deviation value of Hangzhou canal section is 0.914. It's the median of the three regions. It proves that the number of garbage cans in this area can basically meet people's satisfaction. In addition, the number of garbage cans in tourist areas will be higher than that in residential areas, so people's opinions on the setting of the number of garbage cans in this area are relatively consistent. In the ancient Canal section of Shaoxing, the standard

deviation of the number of garbage cans was 0.839, which was the lowest value in the three regions, and the number of garbage cans in this region was basically consistent.

The standard deviation of the bin in Hangzhou Binjiang section reached 1.289, which was significantly higher than that of the other two areas, indicating that people had different opinions on the design of the bin in this area. The modelling of the trash as a space smaller structures, at the time of design should reflect the culture of the space and dynamic atmosphere of the space, at the same time of loading garbage beautify the environment, to integrate into environment, forming environment of a small point of landscape, to complete its transformation on the function, will lead to more comfortable space for people to experience. The standard deviation of dustbin modeling in Hangzhou canal section and Shaoxing ancient Canal section is close to 0.879 and 0.818, respectively. This shows that people's opinions on the design of the trash can are relatively unified. The spatial environment of the ancient canal has a strong attribute of water culture, which also has a great influence on other designs during the design. Therefore, small landscape elements such as the trash can also have a great influence, which increases people's acceptability.

In the survey on the number of signs, the standard deviation of Hangzhou Binjiang section reached 1.174, which was the highest among the three regions. This indicates that people's satisfaction with the number of signs varies greatly in this area, and there is a large room for improvement. Signage is an important basis for spatial navigation. Only with sufficient number of signage can we provide people with timely guidance services within the space, so as to quickly reach the destination and form a better spatial experience. The standard deviation value of the number of signs in Shaoxing Ancient Canal section is 0.864, which is the median value in the three regions. This indicates that people's satisfaction with the number of signs in this area is also poor, and there is a large room for improvement. The standard deviation of the number of signs in Hangzhou Canal section is 0.771, which is the lowest value in the three regions, proving that in the waterfront landscape space under the guidance of tourism, the number of signs will be set more, so as to meet the needs of tourists for guidance and facilitate the use of services by residents.

Fig. 6-4 Photos of information signs of Shaoxing Ancient Canal section(left), information signs of Hangzhou Canal section(middle, right)

In the clarity survey of signs, the standard deviation of the Binjiang section in Hangzhou is still the highest value in the three regions, with a value of 1.259. It shows that people have different opinions on the clarity of signboards. Under the premise of artistic design, signboards should respect their functionality first, so as to avoid ambiguous signboards caused by pure artistry and thus fail to achieve their functional effect. Or the signboard design is more general, the target direction is not accurate, so that people in the space lost direction and reduce the use of space. Secondly, the clear standard deviation value of signs in the ancient Canal section of Shaoxing is 0.864, indicating that there is also room for improvement in the clarity of signs in this area. The first principle of signage design should respect its clear indication, followed by attention to aesthetics, so as to achieve the perfect integration of the site and the space environment. The clarity standard deviation value of the signage of Hangzhou Ancient Canal section is 0.788. Is the lowest value in the three regions, which proves that people's opinions on the clarity of signage are relatively unified, which can meet People's Daily life and tourism guide needs.

In the survey on the convenience of self-storage, the standard deviation of Binjiang section in Hangzhou reached 1.074, which was the highest value in the three regions, indicating that people believed that the convenience of self-storage in this space was poor and there was a large space for improvement. The standard deviation of self-storage of the Hangzhou canal section is 0.929. In this space, the tourists occupy a large proportion, and the demand for self-storage of articles is also higher. Therefore, more convenient self-storage services should be provided for the people in the space. In the ancient Canal section of Shaoxing, the standard deviation value is 0.880, which is the lowest value in the three regions. From the analysis of spatial activity attributes, the active population in this space is mainly residents, and the demand for self-storage of articles is relatively low, so opinions are relatively unified.

In the survey of motorized parking services, the standard deviation of The Binjiang section in Hangzhou reached 1.093, which was the highest in the three regions. This indicates that when urban

people are engaged in outdoor space activities, the number of people who choose to drive by themselves is large, and the demand for parking services is large. Therefore, more parking services should be considered in the design of waterfront landscape space, so as to relieve people's worries about travel and make people more willing to go to the space for activities. The standard deviation of motorized parking in Hangzhou Canal section reached 0.972. Residents and tourists in the space were the two main activity groups, and the relative demand of residents for parking services was relatively low. Most tourist activity groups went to Hangzhou by public transport, so there was an average difference in opinions on motorized parking within the area. In Shaoxing Ancient Canal section, the standard deviation of motorized parking is 0.841, which is the lowest value in the three regions. It shows that the positioning of the target population in the public activity space determines the setting of space parking service to a large extent.

6.3 Entertainment

The entertainment of outdoor space activities is a key indicator that people are willing to yearn for. The theme style in the space is closely related to the activity group. Therefore, the implementation of entertainment in the space is a key element to judge the vitality of the space. According to the investigation in the three regions, the questionnaire conducted investigation and statistics from the aspects of the number of facilities for children, the safety of facilities for children, the number of facilities for the elderly, the safety of facilities for the elderly, the number of fitness facilities and the types of fitness facilities. The statistical results are as follows:

Table. 6-3 Description statistics of entertainment facilities within three areas

Category	Item	Hangzhou waterfront space	Hangzhou section of the Canal	Shaoxing section of the Canal
Children facilities quantity	Average	3.5588	3.6075	4.0179
	SD	1.09521	1.08141	0.75911
Children facilities safety	Average	3.5784	3.7043	3.8839
	SD	0.99937	1.05712	0.86728
Old facilities quantity	Average	3.7157	3.7903	3.9286
	SD	0.96859	1.02620	0.76775
Old facilities safety	Average	3.7745	3.8118	3.9554
	SD	0.90002	0.98204	0.79852
Fitness facilities quantity	Average	3.7745	3.7419	4.0268
	SD	0.99411	1.03874	0.89503
Fitness facilities safety	Average	3.7843	3.7366	3.9643
	SD	0.99132	1.03999	0.83751

In the survey on the number of children's facilities, the standard deviation of Hangzhou Binjiang section was the highest, 1.095. This indicates that people's satisfaction with the number of children's facilities in the space is low and their opinions differ greatly. As the main integrated space for residents' daily activities, this space should take into account the travel frequency of children as a special group, and set up corresponding facilities for children timely. When families travel together, the relevant influencing factors of children should also be taken into account, so as to reflect timely care for children in the space. The standard deviation of the number of children's facilities in Hangzhou canal section is 1.081, which is the median value in the three regions. Instructions in tend to travel service of waterfront space, people pay closer attention to children for tourist travel together in child related factors to consider more comprehensive, but because of the complexity of the tourism space in the crowd, the number of facilities for the children evaluation standard mixed, so the data is also exist the bigger difference of the crowd. In the Ancient Canal section of Shaoxing, the standard deviation of the number of children's facilities was 0.759, which was the lowest among the three regions. It shows that people are satisfied with the number of children's facilities in the space, which can basically meet the needs of daily activities.

Fig. 6-5 Photos of Hangzhou Qiantang River section children space

In terms of the safety of children facilities, the highest standard deviation value of Hangzhou canal section was 1.057. This value can be analyzed from two aspects. First, Hangzhou Canal section, as a relatively mature tourist area, has a relatively high activity density of people within the area, and the type of activity population is also relatively complex. There are many factors influencing the safety of children's facilities. And when the population flow density is large, it is not conducive to the safe use of children's facilities. In the area, there are more concerns about the safety of children's facilities. In the Binjiang section of Hangzhou, the standard deviation of the children facility safety survey was 0.999. Relatively speaking, there are also high differences of opinion. As a comprehensive space for People's Daily activities, the daily loss of children's facilities is relatively

large. There are also a variety of unsafe factors. Therefore, for frequent use of residential living space, children's facilities should be more stringent safety checks and indicator Settings. In the ancient Canal section of Shaoxing, the standard deviation of children's facility safety was 0.867. As a whole, people's opinions are relatively unified, and they are satisfied with the safety considerations of children's facilities, which generally meet the demand. However, it can be found that the use of children's facilities in Shaoxing Canal section is low due to the small number of children's facilities, so the value is also at a low level.

In the survey on the number of elderly facilities, the standard deviation of Hangzhou canal section reached 1.026, which was the highest value in the three regions, indicating that people's opinions on the number of elderly facilities in this region were not consistent. In the tourism-oriented canal space activities, tourists are given more consideration, so the number of elderly facilities may be neglected. On another level, the number of elderly facilities is in short supply due to the large population density in the space. Especially during traditional events or festivals, the number of tourists in the region surged. The number of facilities for the elderly is in short supply, which leads to the high value, inconsistent opinions among the population, and low satisfaction with the number of facilities for the elderly. Therefore, in the design of such tourism-oriented waterfront space, we should consider the difference between the flow of daily activities and the flow of tourist activities, and do a good job in the elastic change between facilities, so as to timely reach the balance of supply and demand. The standard deviation of the elderly facilities in Hangzhou Binjiang section is 0.968. This suggests that there is also some disagreement about the number of elderly facilities in the area. The active population in this area is mostly the surrounding residents, so the number of elderly facilities can be set based on the consideration of the structure of the surrounding population, to meet the needs of the population in the space to the greatest extent. In the ancient Canal section of Shaoxing, the standard deviation of the number of elderly facilities was 0.767. People's satisfaction with the number of facilities for the elderly is relatively uniform, which can basically meet the needs of daily life.

In the safety survey of elderly facilities, the standard deviation value of Hangzhou canal section was 0.982, which was the highest value in the three regions. The reason for such a high value in the space is closely related to the high density of per capita activity in the space. At the same time, as a traditional ancient water system, Hangzhou canal section will have a lot of traditional water-loving space around the water system, such as water quay, so there are certain safety risks for special groups such as children and the elderly. When the density of people in the space is too high, the loss of elderly facilities will be greater. There is also more instability. In the Binjiang section of Hangzhou, the standard deviation value of the safety of the elderly facilities is 0.900, indicating that the population in this area has the same concerns about the safety of the elderly facilities. The elderly,

as a special group in space activities, should be combined with the basic activity needs of the elderly to carry out safety design of facilities for the elderly, reflecting the friendliness of space for the elderly. In Shaoxing ancient canal space, the standard deviation value for the safety of elderly facilities is 0.798. The value is at a low value, and people are basically satisfied with the safety of the activity facilities for the elderly in the space.

In the statistics of the number of fitness facilities, the standard deviation of Hangzhou canal section reached 1.038, which was the highest value in the three regions, indicating that people's opinions on the number of fitness facilities in this region were not consistent. The reason for this situation can be analyzed from the perspective of Hangzhou canal section space itself as a tourist gathering and distributing space. The space is more oriented towards tourists, so the setting of the space is more about tourism services and less about daily residents' life services. Therefore, it is possible to choose appropriate space locations to increase the number of fitness facilities. The standard deviation value of the number of fitness facilities in Hangzhou Binjiang section is 0.994. It proves that people's satisfaction with the number of fitness facilities in the area also has certain objections. Such a result can be generated due to the small number of fitness facilities or the shortage of fitness facilities. Therefore, it is necessary to judge the number of fitness facilities according to the density of people in space. In Shaoxing Canal section, the standard deviation of this kind of value reaches 0.895, which is the lowest value in the three regions. Of course, it is also inseparable with the density of crowd activity in the space, which proves that the density of crowd activity in this region is relatively low, and the number of fitness facilities can basically meet the needs of the crowd.

In the statistics of fitness facilities, the standard deviation value of Hangzhou canal segment reaches 1.039, which is significantly higher than the other two locations. Combined with the above quantitative analysis of fitness facilities, we can find that the number of fitness facilities in this region is small and the types of fitness facilities are relatively simple. In this regard, the number of fitness facilities can be moderately increased while the types of facilities can be enriched, so as to provide residents and tourists in the region with a better sense of space experience. The standard deviation of the fitness facilities in Hangzhou Binjiang section was 0.991, which was in the middle level. This indicates that people believe that the variety of fitness facilities in this area can still increase its abundance to meet the activity needs of a variety of people. The standard deviation of the fitness facilities in Shaoxing Canal section is 0.837, which is lower than that in the three regions, indicating that people believe that the fitness facilities in this region basically meet the needs of the population.

6.4 Comfort Design

Comfort in the space is an important indicator of the service level of the space and a key factor in attracting people to re-enter the space. In this area, the detailed design directly affects the spatial experience and satisfaction of the crowd. Therefore, the research questionnaire provides statistics on the accessible facilities, pavement texture, pavement color, pathway width and walkway route in the comfort design. The statistical results are as follows：

Table 6-4 Descriptive statistics of comfort design in the three regions

Title	Item	Hangzhou Riverside Section	Hangzhou Canal Section	Shaoxing Canal Section
Accessible facilities	Mean	3.8039	3.7634	4.0446
	SD	0.94439	1.02296	0.82077
Pavement texture	Mean	3.9216	3.9946	3.9643
	SD	0.89759	0.78841	0.84819
Pavement color	Mean	3.9314	4.0108	3.9554
	SD	0.89287	0.84463	0.83167
Pathway width	Mean	3.9020	4.0430	4.0446
	SD	1.01970	0.80423	0.75203
Walkway route	Mean	3.9412	4.0591	3.9911
	SD	1.05139	0.80656	0.88527

In the accessible facilities design survey, the value of the standard deviation of the Hangzhou Canal section reached 1.022, which is significantly higher than the other two regions. This proves that people's opinions on accessible facilities are more diverse in this region. There is a lot of room for improvement in accessible facilities. As a major urban tourism space, the Hangzhou Canal section should take accessibility design into account in more ways. In this way, it will be able to provide better accessibility services even for complex groups of people. At the same time, the number of barrier-free facilities should be higher than other spaces to meet the denser flow of people activities in the space. The value of the standard deviation of the accessible facilities of the Hangzhou Riverside Section is 0.944, which proves that it still has a high room for improvement in this space. The accessibility design of the space should be considered more carefully when targeting residents' activities. It should be able to meet the service needs of residents throughout the day, and also allow residents to experience the friendliness of the space, thus creating a better spatial experience. The standard deviation of the accessible facilities design in the Shaoxing Canal section

is 0.820, which is the lowest value in the three regions, indicating that the overall demand is basically satisfactory.

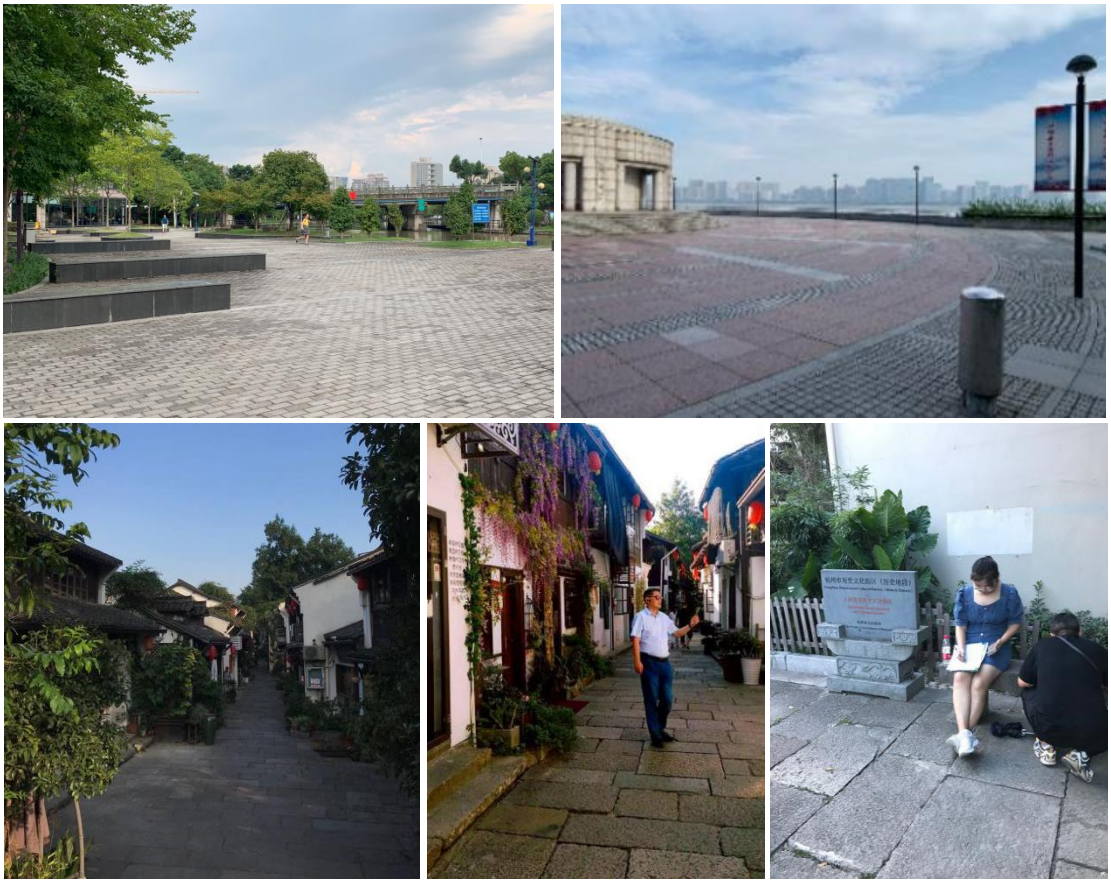

Fig. 6-6 Photos of pavement texture: Shaoxing Ancient Canal section (top left), Hangzhou Qiantang River section (top right), Hangzhou Canal section (bottom)

In the study of pavement texture, it was found that the Hangzhou Riverside section had the highest standard deviation value of 0.897, followed by the Shaoxing Ancient Canal section with a standard deviation of 0.848. This proves that people have more objections to pavement texture in these two spaces. The pavement texture of Hangzhou Riverside District, an emerging residential activity space, is mostly made of hard marble or other ecological pavement, which makes the pavement feel more rigid overall. However, as it is an activity space for residents, the design of the pavement texture can favor a soft material in certain areas to reflect the friendliness of the space and attract residents to the space.

The pavement texture design of the ancient canal section of Shaoxing was enhanced based more on the surviving features of the canal. The pavement texture were designed with respect for the unity of the landscape. People have different opinions about the pavement texture in the space. When redesigning traditional spaces, the choice of pavement texture can be based on a combination of

traditional and new materials to cover the space. This not only satisfies the pursuit of traditional culture, but also provides the convenience of modern travel. The standard deviation of pavement texture in the Hangzhou Canal section is 0.788, which is at a low level. This proves that people's opinions on the pavement texture in the space are relatively unanimous. The pavement texture in the space can basically satisfy the two needs of culture and passage.

In the study of pavement color, it was found that the standard deviation values in the three regions were not very different. The standard deviation values were 0.892 for the Hangzhou Riverside section, 0.844 for the Hangzhou Canal section, and 0.831 for the Shaoxing Ancient Canal section. From this phenomenon, we can see that for pavement color, there is a more uniform implementation of standards in the space. The design of pavement color basically presents a standardized pattern, thus people's opinions are more unified. At the same time, we can see from another aspect that the design of pavement color tends to be more homogeneous, so that less interest is reflected in the space. This means that when designing pavement colors for waterfront areas, it is possible to incorporate cultural colors that complement the environment, enhance the artistic sense of the road, and increase the attractiveness and favorability of the space.

Fig. 6-7 Photos of Shaoxing Canal Walkway (left), Hangzhou Canal Walkway (middle), Hangzhou Qiantang Rriver Walkway (right)

In the survey of pathway width, it was found that the highest standard deviation value was 1.019 in the Hangzhou Riverside section, which means that there is a large difference of opinion on pathway width in this area. It is possible that the setting of the pathway width may cause inconvenience to people at some time or in some space, thus generating large differences of opinion. The design of pathway width mostly follows standard regulations, but the actual width in the area should be adjusted to take into account the actual pedestrian and traffic routing in the space. The standard deviation of pathway width in the Hangzhou Canal section is 0.804, which is in the middle of the range. The design of it in the Hangzhou Canal Section is more optimized based on the traditional spatial form. People are more familiar with traditional spaces, so they have fewer objections and are more uniformly satisfied with the spatial trail width. The standard deviation of

pathway width in the Shaoxing Canal section is 0.752, and people's opinions on it are unanimous. Thus, it can be considered that the pathway width can basically meet people's daily needs.

In the survey on walkway route setting, the highest standard deviation value is 1.051 for the Hangzhou Riverside section, which indicates that people think the walkway route setting in this space is unreasonable. In the setting of walkway route in the waterfront landscape space, it usually follows the planning principle of urban traffic flow, while considering the behavior and habits of the surrounding population. So that it can simultaneously meet the daily fitness, traffic flow, tourism distribution and other functions. The standard deviation of walkway route in the Shaoxing Canal section reached 0.885, indicating that the setting of route in this area is considered to be in need of improvement. The distribution of walkway route should be improved by taking into account the surrounding usage and urban traffic network. The standard deviation of walkway route in the Hangzhou Canal section reached 0.806, indicating that people who move around the space consider route to be reasonable. The design of walkway route can basically meet the needs of circulation and fitness.

6.5 Survey of spatial overall quality

Spatial overall quality is a comprehensive evaluation based on the above detailed survey design, which is an analysis of the overall satisfaction of the space and an important index to evaluate the population's secondary access to the space. Therefore, this study investigated and analyzed seven aspects: Transport convenience, Urban characteristics, Government attention, Planning design, User's perspective, Individual characteristics, and Separation zone planning. The statistical results are as follows.

Table 6-5 Descriptive statistics of the spatial overall quality survey in the three regions

Title	Item	Hangzhou Riverside Section	Hangzhou Canal Section	Shaoxing Canal Section
Transport convenience	Mean	3.7941	4.0430	3.9464
	SD	0.99840	0.85631	0.88876
Urban characteristics	Mean	4.0294	4.0753	3.1161
	SD	0.88391	0.82182	1.12102
Government attention	Mean	4.0882	4.2043	3.9732
	SD	0.87995	0.77193	0.85382
Planning design	Mean	4.1569	4.2527	3.4107
	SD	0.85301	0.75381	0.57819
User's perspective	Mean	4.0784	4.1505	4.1429
	SD	0.95115	0.80467	0.80379
Individual characteristics	Mean	4.0196	4.1129	3.2500
	SD	0.82029	0.76628	1.06965
Separation zone planning	Mean	4.1667	4.2043	4.0625
	SD	0.92365	0.84545	0.88309

In the transportation convenience survey, the standard deviation value of the Hangzhou Riverside section reached 0.998, which means that people think there is still room for improvement in the degree of transportation convenience to reach the space, and the space is not convenient enough. The problems of private traffic parking or the convenience of public transportation may have an impact on people's evaluation of the transportation convenience. Therefore, the waterfront space of Hangzhou Riverside Canal section should be given an adaptive strategy in terms of the degree of transportation convenience. The urban space is not only a service space for the surrounding people, but also a service space for the whole city. In the ancient canal section of Shaoxing, the standard deviation value reached 0.888, indicating that people consider the degree of accessibility to the space to be considerable. People could reach the space in time by their own transportation or public transportation. In the Hangzhou Canal section, the standard deviation of accessibility was 0.856, and people were satisfied with the overall accessibility to the space. The accessibility of the space is perceived to be high. Therefore, they will make secondary and multiple visits to the space, which enhances the vitality of the space.

The standard deviation of the Shaoxing Canal for urban characteristics was found to be significantly higher, with a value of 1.121, indicating that people in the region generally believe that space does not reflect urban characteristics, or the degree of reflection of urban characteristics is

low. Urban characteristics are a significant factor in spatial shaping, and only when spatial characteristics can be reflected, can city business cards be jointly shaped. Therefore, the Shaoxing Canal section can be adjusted to the surrounding water culture, urban development culture and future positioning of the spatial characteristics in a timely manner. The standard deviation of the urban characteristics in the Hangzhou Riverside section is 0.883, indicating that there is still much room for improvement in the expression of it in the space. There are few settings that reflect the urban characteristics of the space, and the cultural heritage of the space is low, which should be improved in time. In the Hangzhou Canal section, the standard deviation of urban characteristics is 0.821, indicating that people think that the urban characteristics can be better reflected in the space, and that the unique local culture can be combined with the urban development landscape to achieve empathy and sympathy in the space.

In the survey on government attention, the standard deviation values presented by the three regions are not very different. From highest to lowest, they are 0.879 for Hangzhou Riverside, 0.853 for Shaoxing Canal, and 0.771 for Hangzhou Canal, indicating that the power of government intervention is relatively strong in shaping urban space. With government intervention as the dominant force and citizen participation as the support, the whole urban space is gradually shaped.

In the planning design survey, it was found that the Hangzhou Riverside Section and the Shaoxing Canal Section exhibit a large difference in standard deviation. The standard deviation values are 0.853 for the Hangzhou Riverside section and 0.578 for the Shaoxing Canal section. The possibility that such differences exist is not excluded due to the different populations in the urban activity space and the different positioning of the development of different cities, which leads to different levels of demand for space. In addition, the level of per capita income also has a significant impact on the demand for space. Therefore, it should be judged according to the specific situation of the space. The planning and design standard deviation of the Hangzhou Canal section is 0.753, which is in the middle level. This proves that people are more unified and satisfied with the overall planning and design in this region.

From the user's perspective, it is found that the standard deviation values for the Hangzhou Riverside section are quite different. This shows that people's opinions about the use of this space vary greatly. As an urban waterfront space mainly for people's lives, the Hangzhou section of the riverfront is mainly for city residents and some foreign tourists, and there are more diverse factors in the demand for the space. As it is a new urban service space, the cultural heritage embodied in the city is slightly inferior to that of the canal section, so the different needs of the crowd can not be fully satisfied. This may result in such a large numerical difference. The standard deviations of user experience for the Hangzhou and Shaoxing Canal section are similar, 0.804 and 0.803 respectively,

which proves that people are more comfortable with the use of space in such cultural tourism distribution spaces. Users' opinions are also more unified, and they are able to experience both culture and usability in such waterfront spaces.

Fig. 6-8 Photos of Characteristic spaces in Hangzhou Canal section (left), Shaoxing Ancient Canal section (middle), and Hangzhou Qiantang River section (right).

In the process of researching individual characteristics, the data showed that the Shaoxing Canal section had the highest standard deviation of 1.069. This indicates that people think that the space does not reflect the characteristics of the space well, or that the personal characteristics embodied in the space can not be captured by people in time, resulting in a lack of empathy. In this kind of traditional ancient canal waterfront space, the personality and characteristics of the space should be closely linked to history and culture, so that the crowd can feel such characteristics and culture in time when visiting the space, thus enhancing satisfaction with the space and even the characteristics of the entire city. The standard deviation of the individuality of the Hangzhou waterfront is 0.820, indicating that the individuality of the space in this region needs to be improved. Most urban waterfront spaces are too similar. The dominant character of the city today cannot be reflected. Therefore, when shaping the waterfront space, we should first consider the city's thematic characteristics, and contain them in the waterfront space, so as to achieve the echo between the city and the culture. The standard deviation of the canal in Hangzhou is 0.776. This means that people think that the space can better reflect the personality and characteristics of the city, and they can perceive the unique canal culture and its features in the space. This leads to a high level of satisfaction in visiting the space, and people are more unified in their opinions about the individual characteristics of the space.

The standard deviation of the urban separation zone planning is 0.923, which is the highest value, indicating that the planning of the separation zone in this space is still inadequate. The reason can be analyzed from the spatial attributes of the city. As the main public space of the city, the waterfront space of Hangzhou Riverside Section is more open, more public, and more connected to the outside space. Thus we can see that people are more attracted to spaces that are more private. Hangzhou

canal section can be modified to meet the semi-private needs of people for outdoor space. Standard deviation value of 0.883 for the Shaoxing Canal section of separation zone planning proves that there is still room for improvement in this area. In this type of traditional waterfront space, soft vegetation can be used to create a spatial separation. This can increase the green area as well as provide a spatial separation. Cultural atmosphere of the space is also improved. This proves that people have a relatively unified opinion on the spatial segregation plan. While satisfying the needs of crowd activities in the space, it can also ensure the privacy of crowd activities.

6.6 Survey of opinions on the renovation

The renovation opinion of a space is based on an evaluation of the whole space. We can find out the main aspects of the current space that can be improved from both the survey of renovation opinion and the analysis of the whole space, so that we can make targeted improvements to make the waterfront space meet the needs of the people. In this questionnaire, we gave the following four options: Increase in indoor leisure space, Increase in theme exhibition or shows, Increase in E-vehicle and Increase in large business services. The statistics for each of the three spatial areas were presented and the results are as follows.

Table 6-6 Descriptive analysis of opinions on the renovation in the three regions

Title	Item	Hangzhou Riverside Section	Hangzhou Canal Section	Shaoxing Canal Section
Increase in indoor leisure space	Mean	4.1078	4.1559	4.2143
	SD	0.91095	0.87758	0.84287
Increase in theme exhibition or shows	Mean	4.0490	4.0914	3.9107
	SD	0.99879	0.93994	0.93533
Increase in E-vehicle	Mean	3.6373	3.7634	4.0804
	SD	1.17557	1.12848	0.94094
Increase in large business services	Mean	3.7647	3.8817	3.9821
	SD	1.21196	1.13756	1.03960

In the survey of increase in indoor leisure space, the standard deviation of 0.842 for the Shaoxing Canal section is the lowest among the three regions, which proves that people in this region are more unanimous in their demand for more open spaces. This indicates that the amount of facilities in the open space is a little insufficient. In future improvements, we can consider adding appropriate

resting spaces to ease people's comfort in space experience. Hangzhou Canal section's standard deviation value is 0.877, which is the middle value of the three sections. It proves that people think that some more open space can be added to the space. The reason why this data is generated can be analyzed as the density of people in the tourism space of mainstream cities is greater, and the demand for rest space is also greater. Therefore, indoor leisure space can be appropriately increased in this type of large-flow tourism space to meet the needs of more people. Standard deviation of increase in indoor leisure space in Hangzhou Riverside section is 0.910. People's opinion is large, which proves that people think that rest space can be increased in this space. But some people are satisfied with the current space setting. It can be found that adding rest space in Hangzhou Riverside Section is not the main demand for space improvement.

In the survey on increase in theme exhibition or shows, it was found that the values were more uniform in the three regions. By comparing the data, we can see that the demand for more themes plazas is not large in the Hangzhou waterfront. The demand for more themed plazas is relatively high in the two waterfront spaces surrounding the ancient canal system: the Hangzhou Canal section and the Shaoxing Canal section. This proves that the extension of waterfront spaces around such cultural rivers should be more thematically promoted. When planning and designing spaces, more consideration should be given to thematic spaces in order to achieve the best sense of use and experience. It is important to make the local residents feel the charm of the city's cultural space, as well as to make foreign visitors perceive the mainstream characteristics of the city.

In the survey on the demand of increase in E-vehicle, it was found that the values were higher for the Hangzhou Riverside Section and the Hangzhou Canal Section. It can be seen that the public is not unanimous in their demand for more E-vehicle. This reason of difference is different groups of people have different activity demands in the urban activity space. Residents and tourists who tend to work out prefer more space for walking. On the other hand, visitors who are more inclined to sightseeing and browsing would like to see an increase in the number of E-vehicles. The difference in values is relatively large. The standard deviation value of 0.940 for the Shaoxing Canal Section clearly reflects the desire for more E-vehicles in the space compared to the other two spaces. However, around the ancient canal, the capacity of the waterfront space is limited, and adding E-vehicle may have an impact on the space. Therefore, the decision should be made based on the actual situation.

In the survey on the increase in large business services, the standard deviation of the Shaoxing Canal section was the lowest of the three areas, with a value of 1.039. This indicates that it is considered appropriate to add commercial facilities in the area to meet the service needs of residents and visitors alike. At the same time, it can also serve as an original vitality of the space to attract

more people to the space. The second is the Hangzhou Canal section, where the standard deviation for the increase in large business services is 1.137, reflecting the fact that the current commercial facilities already meet the needs of the population. Although it is still possible to increase it appropriately, more attention should be paid to reflecting cultural expression rather than purely commercial occupancy. The value of the standard deviation for increasing in large business services in the Hangzhou Riverside Section is 1.211, which is relatively large, indicating that people do not consider adding commercial facilities in this space to be the main demand of the space, and people's opinions are not unanimous.

6.7 Research purpose and significance

6.7.1 Reliability test

In this paper, the most commonly used alpha reliability coefficient method was chosen for the reliability test, and the results are summarized in Table 7. From the table, it can be seen that the alpha coefficients of landscape satisfaction scale, service facilities satisfaction scale, entertainment facilities satisfaction scale, comfort design satisfaction scale, spatial overall quality scale, and renovation opinion survey scale are all higher than 0.7, indicating that the scales used in this survey have high reliability.

Table 6-7 Reliability test analysis table

Scale	Survey Location		
	A	B	C
Visual Landscapes	0.9485	0.8908	0.7986
Service facilities	0.9505	0.9504	0.8474
Entertainment facilities	0.9390	0.9430	0.7029
Comfort design	0.9413	0.8796	0.7194
Spatial overall quality	0.9243	0.8779	0.7089
Renovation opinion survey	0.8907	0.8539	0.7327

6.7.2 Comprehensive analysis

A comprehensive analysis of the six influencing factors in the three spaces was conducted to make a clear judgment on the improvement indicators of the current space. The results of the statistical analysis are as follows. (The lower the standard deviation value, the more unified the improvement opinions are. The higher the value, the greater the difference in current improvement opinions, which is not the mainstream demand.)

Table 6-8 Composite descriptive statistics of the six influencing factors in the three regions

Dimensionality	Statistical Items	Hangzhou Riverside Section	Hangzhou Canal Section	Shaoxing Canal Section
Visual Landscapes Service facilities	Mean	4.0556	4.0263	3.9276
	SD	0.7537	0.6046	0.5262
Service facilities	Mean	3.5673	3.8932	3.9375
	SD	0.8404	0.6887	0.4760
Recreation facilities	Mean	3.6977	3.7321	3.9628
	SD	0.8693	0.9157	0.5217
Comfort design	Mean	3.9000	3.9742	4.0000
	SD	0.8669	0.7047	0.5689
space overall quality	Mean	4.0476	4.1490	3.7083
	SD	0.7490	0.6106	0.5079
renovation opinion	Mean	3.8897	3.9312	4.0469
	SD	0.9384	0.8876	0.7019

In the analysis of visual landscape elements, it can be found that the Shaoxing Canal section has a more unified intention to shape the visual landscape, with a standard deviation of 0.526, indicating that people have a relatively urgent need for visual elements in the space. The space should be optimized and improved for the visual landscape, especially in the lighting performance. According to the previous special analysis, in the ancient canal section of Shaoxing, people's opinions on improving the lighting performance are more unified. The standard deviation is 0.604. According to the previous special analysis of visual landscape, the demand for lighting effect is more unified in the Hangzhou Canal section. The people all think that the visual effect should be improved as a whole. The standard deviation of the visual landscape in the Hangzhou waterfront section is 0.753, and people's satisfaction with the visual effect is relatively unified, with no obvious difference, and the visual landscape elements basically meet people's needs.

In the analysis of the landscape elements of service facilities, it can be found that the Shaoxing Canal section has a clearer intention to improve the service facilities. The standard deviation is 0.476,

which is the lowest value in the three regions. According to the previous analysis, the demand for the style of bathroom is more unified in the service facilities in the ancient canal section of Shaoxing. This means that people's satisfaction with the style of the bathroom is relatively low in the current space, and their opinions on renovation are relatively unified. The redesign of the bathroom style should be done on the basis of the current spatial culture. Secondly, the standard deviation of the service facilities in the Hangzhou Canal section is 0.668, indicating that people's intention to increase the service facilities in the current space is relatively unified. For the areas with a high density of active people in the space, service facilities should be added to improve the situation where the supply of people exceeds the demand in times of high activity. The standard deviation of service facilities in the Hangzhou Riverside Section is 0.840, which proves that the service facilities in the space are basically satisfied in this area. The improvement of service facilities was not considered to be the main demand of the space, and people's opinions were not unanimous.

The standard deviation of the Shaoxing Ancient Canal section was the lowest of the three areas in the recreation facilities analysis, with a standard deviation of 0.521. This indicates that there is a large demand for additional entertainment facilities in the Shaoxing Canal Section. Entertainment facilities in the space should be a source of vitality for the space, and the appropriate addition of it in the waterfront space can enhance the vitality and attractiveness of the space. Second, the standard deviation of entertainment facilities in Hangzhou Riverside Section is 0.521, which is the lowest of the three areas. Entertainment facilities in the space should be a source of vitality for the space, and the appropriate addition of it in the waterfront space can enhance the vitality and attractiveness of the space. Second, the standard deviation of entertainment facilities in Hangzhou Riverside section is 0.869, which is the median value in the three regions, indicating that people have their own opinions on the addition of entertainment facilities in the current space. This is because different groups of people in the space have different activity demands. The addition of entertainment facilities is more likely to target children or young people. Therefore, the complexity of the population in the integrated space also contributes to this data result. The standard deviation of recreational facilities in the Hangzhou Canal section is 0.915, which indicates that the addition of it is not the main demand of the space in this area.

In the survey of comfort design data, it was found that the standard deviation of the Shaoxing Canal section was the lowest of the three regions, with a value of 0.568. It indicates that the current comfort design of the space is considered to have room for improvement. The experience of comfort in a space is an important indicator of how long people stay in the space and how often they visit the space. Therefore, appropriate comfort improvement should be made in the space to better meet people's needs and leave a more comfortable impression for the space. Secondly, the standard deviation of comfort design in the Hangzhou Canal section is 0.704, which proves that people think

that there is still a high room for improvement in comfort design in the current space. Thus, the design can be optimized according to the current spatial elements and improved on the current situation to increase people's comfort and space friendliness. The standard deviation of the comfort design degree of the Hangzhou Riverside Section is 0.866, indicating that people's opinions on the current comfort design of the space are relatively unanimous. It also proves that the comfort design of the current space can basically meet the needs of the people and is not the mainstream demand of the current space.

In the survey on the space overall quality, it was found that the lowest standard deviation of 0.507 was found in the Shaoxing ancient canal section, which proves that people are more unanimous about it. People think that the overall space should be adjusted to meet the activity habits of the crowd and create a better overall effect for the space. The standard deviation of the survey on space overall quality is 0.610, indicating that people believe that there is room for optimization of space integrity in the current space. The above indicators can be optimized one by one to improve the spatial overall quality. The standard deviation value of 0.749 for the survey of spatial integrity in Hangzhou Riverside section. It proves that people are basically satisfied with the current space and the improvement of it is not a mainstream demand.

In the survey on renovation opinion, it was found that Shaoxing Canal section had the lowest standard deviation of 0.701, indicating that people have a strong and unified willingness to renovate the current space. For the specific transformation of this space, we can refer to the special analysis in the previous section. Secondly, for the Hangzhou Canal section, the standard deviation of the intention to renovate is 0.887. This reflects that people think that there are still renovations that can be improved in the current Hangzhou Canal section, which can be rectified one by one according to the special analysis in the preceding text. Finally, the standard deviation of the survey on the intention to renovate the Hangzhou Riverside Section is 0.938, indicating that people are more satisfied with the tendency of renovation in the current space. The difference of opinions on whether to improve or not is large, and the space basically meets the current demands.

Reference

[1] Binyi Liu, Modern Landscape Planning and Design (Third Edition) [M], Southeast University Press, 2010-1-1

[2] (Australia) by John Pigram, John Jenkins, translated by Gao Jun et al.. Outdoor Recreation Management [M].Chongqing University Press, 2011.

[3] Donatella Cialdea. Landscape Features of Costal Waterfronts: Historical Aspects and Planning Issues. 2020, 12(6)

[4] (U.S.) Gan Hamann, translated by Lin Huaqing The Fourth Wave [M].Beijing: China Friendship Publishing Company, 1984.

[5] Jules, Goddard, Metcharis. The Future of Large Cities: Berlin, London, Paris, New York - Economic Aspects [M].Beijing: Foreign Trade Education Press, 1991.

[6] David C. Sloane. Review: A Negotiated Landscape: The Transformation of San Francisco's Waterfront Since 1950 By Jasper Rubin. 2018, 38(1):117-118.

[7] Masaaki OKADA, Koichi NAKAMA, Yoshio NAKAMURA. A Study on Visual Features of Industrial Waterfront Facilities For Landscape Design. 1995, 12:383-388.

[8] Daisuke NISHIBAYASHI, Masaaki OKADA. STUDY ON PROPERTY AND EVALUATION OF NIGHT LANDSCAPE IN WATERFRONT. 2005, 21:199-203.

[9] Xinmu Cai. A Study of China's Mining Rights Market Based on Stakeholder Theory [M].Beijing: China Economic Press, 2013：156-157.

[10] Jianhua Chen. Research on the concept and development strategy of waterfront land. [D]. Keelung: Ph.D. Thesis, National Taiwan Ocean University, 2011.

[11] Jun Cai. A Malefactor of National Forest Park Recreation Carrying Capacity [M].Beijing: China Forestry Press, 2010.

[12] (French) by Corbissier. translated by Shi Zhiming. Athens Charter [M].Taipei: Tian Yuan City Culture Business Company, 1996.

[13] Kisho Kurokawa. Symbiotic City [J].Architectural Journal, 2001（4）.

[14] Xiumin Zhao. A Quantification Analysis on Acoustic Landscapes of Waterfront Scenic Areas:. 2009, 8(2):379-384.

[15] Lee Yoo-mi, Yoon Hee-yeon, and Kim Se-hoon. - Urban Waterfronts - an Approach to Landscape Infrastructure. 2017, 59:92-94.

[16] (U.S.) Kevin Lynch, translated by Deng Hua. Urban Form [M].Beijing: Huaxia Publishing House, 2001.

[17] Fuyi Chen, Jinxia Zhang. Overview of China's main tourist source and destination countries [M].Beijing: Tsinghua University Press, 2007.

[18] Xiyin Hu. The Theory and Practice of British Urban Development and its Reference to Shenzhen [M].Peking University Press, 2004.

[19] (USA) Rotos, translated by Guo Xibao and Wang Songmao. Stages of Economic Growth [M]. Beijing: China Social Science Press

[20] Minho Kim, Seonghwan Jeong. Research on create a cultural space and urban regeneration

utilizing Waterfront space : Centered to Jeonju A-jung reservoir Waterfront space design. 2013, 13(1):383-392.

Chapter 7

DISCUSSION

CHAPTER SEVEN: DISCUSSION

7.1 Human usage sense

7.1.1 Integrated senses

From the preceding discussion, we can see that in the waterfront landscape space, the sense of use is more likely to be a combination of senses. People's appreciation of the waterfront landscape environment is often perceived through the changing position of the body in the space. Therefore, the first reaction received by the senses forms the first impression of the space in our minds. Different colors, different forms give us a first sense of the nature of the landscape elements and their appeal. When we are removed from environment, we can still feel the physical touch of the landscape, such as the sound of running water and insects in our ears, the grass or stream flowing beneath our feet, the scent of the earth, and the texture of the breeze on our skin. All this stimulation of the senses creates an unforgettable experience of visiting space in mind. We can make a more profound impression with each landscape experience.

Of course, different people will feel and think differently in the same landscape space, but the impact of the landscape elements within the space is objective. In a waterfront landscape space, we experience a passive experience that is controlled by external factors such as planned oil lines and pre-defined zoning functions. These pre-programmed features and flows will determine the actions of most people. However, there are still some people who will respect the initiative more and choose to have a picnic under a tree or sit somewhere near the water. We will find that the combined sensory impact in a waterfront landscape space is different for different groups of people. And we can start by analyzing the main groups of people who are active in the space, based on the previous classification of people by age level and education level.

Table. 7-1 Analysis of the difference in age of the surveyed persons in different regions

Area	Item	Generation	Mean	variance	Population mean	F value	Significance
Hangzhou Riverside Section	Service Facilities	12-17	3.9000	0.88192	3.5673	18.102	0.000
		18-24	3.8057	0.77870			
		25-34	3.7714	0.59557			
		35-59	3.6754	0.55059			
		>60	2.0778	0.38752			
	comfortable design	12-17	3.9000	0.98658	3.9000	2.887	0.026
		18-24	3.9257	0.88529			
		25-34	4.0429	0.75298			
		35-59	4.0783	0.72045			
		>60	3.1500	1.02381			
Shaoxing canal Section	Overall space	12-17	4.0000	0.60477	3.7083	6.355	0.000
		18-24	3.8472	0.38359			
		25-34	3.4259	0.40650			
		35-59	3.5494	0.44533			
		>60	3.9365	0.54384			

From Table 7-1, we can see that in the survey of service facilities in the Hangzhou Riverside Section, the difference between age groups is very significant, with a significant value of 0.000, which proves that there is a big difference in the space use of different age groups in the space. The difference in recognition of service facilities is more prominent. At the same time, in terms of comfort design, the difference in perception of the space by different age groups is also significant, with a significant value of 0.026, indicating that there are specific differences in the perception of comfort by different age groups. There are also certain differences in the degree of spatial comfort brought by sensory experience in the space. In the overall spatial sensuality of the Hangzhou Canal section, the different age groups have a massive difference in perception, with a high significance value of 0.000, indicating that different age groups have their views on the shaping of spatial integrity in the space. The age groups using the space have a large difference in the overall spatial sensuality, resulting in a high significance.

Table 7-2 Analysis of variance in the educational attainment of respondents in different regions

Area	Item	Education level	Mean	variance	Population mean	F value	Significance
Hangzhou Riverside Section	Service Facilities	Junior or below (below nine grades)	3.5778	0.94463	3.6977	2.674	0.036
		Senior high	4.0247	0.85072			
		Undergraduate	3.6260	0.77976			
		Postgraduate or above	2.8611	0.80565			
		Others	3.7692	0.90661			
	Overall space	Junior or below (below nine grades	4.1810	0.55974	4.4076	3.697	0.008
		Senior high	3.9683	0.79769			
		Undergraduate	4.0801	0.67691			
		Postgraduate or above	3.0952	1.00068			
		Others	4.3956	0.63929			
Hangzhou Canal Section	Overall space	Junior or below (below nine grades)	4.3182	0.63006	3.7321	2.595	0.38
		Senior high	3.9643	0.90876			
		Undergraduate	3.6815	0.92349			
		Postgraduate or above	3.5083	0.84375			
		Others	3.6026	0.96041			

From Table 7-2, it can be seen that in The Hangzhou Riverside Section, the effect of education level on recreation facilities in the waterfront landscape space is more obvious, with a significant value of 0.036. People with different education levels have different experiences with outdoor recreation activities and recreation facilities in the space, so their satisfaction with the facilities also varies greatly, which is also affected by the integrated spatial environment--the effect of perception. The Hangzhou Riverside Section also shows a very significant difference in spatial integrity, with a significance value of 0.008, proving that there are large differences in the influence of education level on spatial integrity perception in this section. The level of education affects people's overall perception of space in both direct and indirect ways.

Thus, in the landscape space. Integrated perception as a subjective aspect occupies a more significant influence on the spatial judgment. In the comfort design part of the Hangzhou Canal section, the significant influence of the population's education level can be seen. It can be seen the significant influence of the education level of the population, the significance value of which is 0.38, proving that in this region, differently educated people have different criteria for judging spatial

comfort. People with lower education levels are more likely to pursue the application of physical space. In contrast, those with higher education levels are more likely to pursue the comfort of the overall cultural atmosphere of the space, thus showing a more pronounced difference.

In a waterfront landscape space, the perception of space is a complex process. The sensory information of the external environment is processed by the brain and transmitted to people's inner activities, thus forming an absolute value judgment of the space, so the activity of landscape perception is a process in which objective things stimulate the senses to produce different reactions in the brain. It is an important method to carry out experience activities and interactive landscape design in waterfront landscape design, through the real feelings obtained by the senses to participate in the landscape experience design.

The visual element is the leading of all the senses, and it is the visual element that comes into play first when we enter a waterfront landscape space. The visual experience helps us to quickly capture other landscape elements such as form, space and color in the environment. And we can see that the visual landscape has a strong correlation to the frequency with which people come here.

Table 7-3 Correlations between the visual landscape of the Hangzhou Riverside Section and distance to the residence and frequency of arrival (the more asterisks, the higher the correlation).

Visual Landscape Items	Statistical Items	Living distance from here Correlation Coefficient	General frequency of arrival here Correlation Coefficient
Greening quantity	Correlation	0.267(**)	0.244(*)
	Significance	0.007	0.014
vegetation type	Correlation	0.140	0.227(*)
	Significance	0.161	0.022
Sculpture quantity	Correlation	0.204(*)	0.220(*)
	Significance	0.040	0.027
Sculpture style	Correlation	0.219(*)	0.186
	Significance	0.027	0.061
area lawn	Correlation	0.118	0.260(**)
	Significance	0.236	0.008
tall tree	Correlation	0.134	0.201(*)
	Significance	0.180	0.043
Lighting Fixtures	Correlation	0.084	0.183
	Significance	0.398	0.065
Night Scene intensity	Correlation	0.178	0.249(*)
	Significance	0.074	0.012
Lighting aesthetics	Correlation	0.112	0.177
	Significance	0.260	0.076

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

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

From Table 7-3, we can see that among the elements of the visual landscape, the amount of greenery and the distance from home have a strong correlation. People usually choose landscaped spaces close to their homes for a short rest or a walk. The desire for natural spaces due to long periods of urban spaces will lead them to choose spaces with a relatively high amount of greenery for leisure activities. We find that there is a strong correlation between the amount of greenery and the frequency of visits. Combining the two analyses, we can judge that there is a strong correlation

between the amount of greenery in the visual landscape on the distance to home and the frequency of coming here, which also reflects people's desire for a green landscape in the visual landscape.

The correlation is also high in the cross-tabulation analysis of plant species and the general frequency of visits. The greater the variety of plants in space, the greater the positive perception of the landscape experience, so the two are inextricably linked.

The correlation values are also high in the analysis between the number of sculptures and distance from home and frequency of visits, which proves that the demand for the number of sculptures is high when people visit this space. The correlation between the sculpture's shape and the distance to the house is also significant. It proves that the shape of the sculpture can attract people to space to a certain extent.

In the analysis of landscape lawns, the correlation between the general frequency of visits and landscaped lawns is significant, proving that the attractiveness of landscaped lawns in waterfront spaces can increase the frequency of people's activities in these spaces to a certain extent. In the analysis of the correlation between tall trees and the frequency of arrival, the correlation is also clearly highlighted, proving that when people engage in outdoor activities in the outdoor space, tall trees, with their site domain and outdoor reliability, will increase the frequency of people arriving in the space.

Finally, the correlation between the brightness of the night scene and the frequency of visits is also significant, demonstrating that during nighttime activities, the visual landscape element is mainly reflected in the brightness of the night scene. People will increase the frequency of activities in the space when the night scene is sufficiently rich, and the illumination is sufficiently satisfying.

Table 7-4 Shaoxing Canal Visual Landscape and Residential Distance Analysis

Visual Landscape Items	Statistical Items	Living distance from here Correlation Coefficient
Greening quantity	Pearson Correlation	0.198(*)
	Sig. (2-tailed)	0.037
vegetation type	Pearson Correlation	0.118
	Sig. (2-tailed)	0.216
Sculpture quantity	Pearson Correlation	0.121
	Sig. (2-tailed)	0.204
Sculpture style	Pearson Correlation	0.070
	Sig. (2-tailed)	0.464
area lawn	Pearson Correlation	0.088
	Sig. (2-tailed)	0.356
tall tree	Pearson Correlation	0.150
	Sig. (2-tailed)	0.114
Lighting Fixtures	Pearson Correlation	-0.090
	Sig. (2-tailed)	0.347
Night Scene intensity	Pearson Correlation	0.224(*)
	Sig. (2-tailed)	0.018
Lighting aesthetics	Pearson Correlation	0.165
	Sig. (2-tailed)	0.082

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

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

In a cross-sectional analysis of the visual landscape and residential distance in the Shaoxing Canal section, a strong correlation was found between the amount of greenery and residential distance. It is shown that the amount of greenery is, to some extent, the primary source of attraction that determines the frequency of people arriving in the space. Secondly, the brightness of the night scene also has a strong correlation with the distance to the home. The two are from day and night. respectively. The relationship between the visual elements and the distance to the home is highlighted. It is demonstrated that an attractive waterfront landscape space should have a significant emphasis on the amount of greenery and nighttime luminance.

In the above analysis, we find that the visual landscape elements are among the most important. The importance of the visual landscape elements in the integrated senses is reflected in the fact that each factor becomes a dominant factor that influences the frequency of activities in the space where people arrive.

7.1.2 Functional adaptability

The functionality of the urban waterfront landscape space includes plant configuration, public facilities, landscaping pieces, guidance systems, recreational facilities, etc. These landscape

elements together make up the function of the waterfront space. They are the expression of the waterfront landscape space environment, the art of cultural quality. The beauty of the waterfront landscape space is not only the beauty of the form but also the overall design layout, which can reflect the functional beauty and connotation beauty of the urban waterfront landscape space. The change of any design element can indirectly change the atmosphere of space and human sensory perception. The good integration and optimization of these various landscape elements can highlight the unique landscape style of the waterfront landscape space.

We will conduct a cross-sectional analysis between landscape elements and crowd activity habits in the three study spaces of the Hangzhou Riverside Section, the Hangzhou Canal Section, and the Shaoxing Ancient Canal, and obtain the following factors that influence the spatial adaptability.

A. Intersection analysis between landscape elements and crowd activity habits in Hangzhou Riverside Section：

Table 7-5 Analysis of the six landscape elements and crowd behavior in Hangzhou's Riverside Section.

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

		Living distance from here	Transportation pattern	Frequency of going here	When do you usually come here	Usually residence time here	the setting of the rest space	For this purpose	How many people
	Sig. (2-tailed)	.115	.406	.085	.947	.768	.227	.851	.
Service Facilities	Pearson Correlation	-.094	-.155	.000	-.124	.156	.045	.022	-.102
	Sig. (2-tailed)	.345	.121	.998	.215	.117	.654	.827	.307
Visual Effects	Pearson Correlation	.200(*)	.158	.257(**)	-.013	.128	.082	.099	-.171
	Sig. (2-tailed)	.044	.113	.009	.898	.201	.412	.321	.086
Recreation Facilities	Pearson Correlation	-.044	-.070	.105	.005	.117	-.053	.036	-.213(*)
	Sig. (2-tailed)	.660	.482	.292	.960	.242	.596	.721	.032
comfortable design	Pearson Correlation	.009	-.005	.012	-.011	.240(*)	-.017	.043	-.145
	Sig. (2-tailed)	.931	.961	.901	.909	.015	.868	.665	.147
Whole space	Pearson Correlation	.180	.185	.201(*)	.043	.080	.015	.103	-.225(*)
	Sig. (2-tailed)	.070	.063	.042	.671	.425	.880	.305	.023
Retrofit Intentions	Pearson Correlation	.037	.049	.238(*)	.067	.123	.064	.068	-.044
	Sig. (2-tailed)	.712	.624	.016	.501	.218	.521	.498	.658

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

As shown in Table 7-5, the importance of functional visibility within the waterfront landscape space is seen in the cross-tabulation analysis of the six landscape elements and people's daily behaviors in the Hangzhou Riverside Section. First of all, we find that the correlation between the visual effect and the distance from home is significant, proving that the visual effect is an essential factor in attracting people to space, and also significantly affects the frequency of people coming here.

The strong correlation between recreational facilities and the number of people who come together in a waterfront landscape space proves that people come together in a space mostly to experience the facilities. Therefore the facilities should be a dominant factor in the attractiveness of the space setting. The comfort of the waterfront space has a strong correlation with the time people spend there, proving that the comfort of the space determines the time people spend in the space. The high cross-sectional influence factor between spatial integrity and the frequency of people visiting and the number of people walking together proves that the overall environment of the space influences the number of visits and the total number of people walking together. The quality of the overall environment will directly cause the frequency of people visiting and the number of people walking together. In terms of intention to remodel, there is a strong correlation between the frequency of visits and intention to remodel, which proves that the merits of the space can be judged by the frequency of people's visits as one of the influencing factors.

B. Intersection analysis between landscape elements and crowd activity habits in the Hangzhou Canal section.

Table 7-6 Cross-tabulation analysis between landscape elements and crowd activity habits in the Hangzhou Canal section.

		Living distance from here	Transportation pattern	Frequency of going here	When do you usually come here	Usually residence time here	the setting of the rest space	For this purpose	How many people
Visual Effects	Pearson Correlation	.061	-.011	.030	.099	.073	.040	.096	.057
	Sig. (2-tailed)	.406	.877	.686	.177	.319	.585	.192	.437
Service Facilities	Pearson Correlation	.098	.003	-.031	.143	.038	-.034	.075	.016
	Sig. (2-tailed)	.181	.972	.672	.052	.603	.647	.308	.828
Recreation Facilities	Pearson Correlation	.048	-.058	-.113	.175(*)	-.010	.048	.072	.040
	Sig. (2-tailed)	.512	.432	.126	.017	.891	.514	.325	.585
comfortable design	Pearson Correlation	.043	-.052	-.066	.140	-.007	-.044	.117	-.032
	Sig. (2-tailed)	.561	.485	.370	.057	.921	.549	.112	.667
Overall space	Pearson Correlation	.052	-.106	.017	.092	-.060	-.095	.041	.039
	Sig. (2-tailed)	.483	.150	.818	.212	.416	.197	.581	.594
Retrofit Intentions	Pearson Correlation	.041	-.043	.007	.117	-.074	.000	-.008	.101
	Sig. (2-tailed)	.574	.560	.926	.113	.315	1.000	.911	.169

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

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

From Table 7-6, we can see that there is a significant correlation between recreational facilities in the waterfront landscape space of the Hangzhou Canal section and when people usually come here. This shows that in traditional ice-water landscape spaces like the Hangzhou Canal, festive recreational activities will attract more people to come to space and experience the activities. The leading nature of the activities in the space is the dissemination of traditional culture. Entertainment facilities mainly represent the translation and presenting of traditional culture. Therefore, the choice of when people come to space is inextricably linked to the recreational facilities or the holding of recreational activities. None of the other indicators had a clear correlation with the daily activities of the crowd, proving that space had been integrated into people's daily lives and that the influence of the historical space on the activities of the crowd was latent, creating a potential rapport between the space and the activities of the crowd.

C. Intersection analysis between landscape elements and crowd activity habits in the Shaoxing Canal section.

Table 7-7 Cross-tabulation analysis between landscape elements and crowd activity habits in the Shaoxing Canal section.

		Living distance from here	Transportation pattern	Frequency of going here	When do you usually come here	Usually residence time here	he setting of the rest space	For this purpose	How many people
Visual Effects	Pearson Correlation	.190(*)	.075	.155	.099	-.123	-.117	-.003	-.107
	Sig. (2-tailed)	.045	.431	.103	.300	.195	.219	.977	.261
Service Facilities	Pearson Correlation	.126	.068	.086	.087	-.119	-.032	.018	-.126
	Sig. (2-tailed)	.185	.478	.368	.360	.210	.740	.849	.184
Recreation Facilities	Pearson Correlation	.064	.114	.119	.144	.053	-.159	.018	.035
	Sig. (2-tailed)	.500	.230	.210	.130	.581	.093	.851	.712
comfortable design	Pearson Correlation	.042	.110	.123	-.016	.119	.059	.029	-.095
	Sig. (2-tailed)	.664	.250	.196	.869	.212	.535	.762	.319
Overall space	Pearson Correlation	-.092	.055	-.050	.114	-.056	.019	-.151	.016
	Sig. (2-tailed)	.335	.566	.599	.231	.557	.842	.112	.866
Retrofit Intentions	Pearson Correlation	.145	.107	.029	.171	-.115	.187(*)	.003	-.095
	Sig. (2-tailed)	.128	.262	.765	.072	.227	.048	.975	.317

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

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

As shown in Table 7-7, the correlation between visual landscape and distance to home in the Shaoxing Canal segment is obvious. It proves that the visual landscape is more attractive to people, and the visual landscape can attract a broader range of people to space for activities and experiences. Secondly, there is a strong correlation between the intention to transform the space and the reasonable distance to set up resting and staying spaces along the walking path. This proves that people's opinion of the reasonableness of the resting space in the space needs to be improved, and

the intention of transformation should be considered in this aspect. All other indicators are equal, which proves that people are satisfied with the functional adaptability of the space when they are active in this space and can meet their daily activity needs.

The urban waterfront landscape space is one of the most dynamic spaces in the city, mainly in the frequency of human activity exchange and biological activity. As an essential public space of the city, the waterfront landscape space has a social function and is a space carrier for people to carry out various activities. This kind of activity can be spontaneous, can be organized, no matter what kind of activity is the vitality of the waterfront landscape space is the embodiment of urban humanistic culture. The functional adaptability of the space also satisfies the needs of people for waterfront landscape activities at the guarantee level. Therefore, when designing a waterfront landscape space, the consideration of functional visibility is the most important thing.

7.1.3 Comfort and convenience

The comfort and convenience of the urban waterfront space is also a vital prerequisite for shaping its vitality. We find that when landscape elements are cross-analyzed with people's behavioral and activity habits, most of the significant values come from the comfort and convenience of getting to space. External accessibility and convenience to the waterfront can increase the efficiency of the use of the waterfront space and maintain public order. Internal access to the waterfront space provides good accessibility to the site and facilitates dynamic and static viewing of the space by citizens and visitors alike.

Table. 7-8 Cross-tabulation analysis of waterfront landscape elements and population behavior in the three regions.

	Hangzhou Riverside Section	Hangzhou Canal Section	Shaoxing Canal Section
Visual Landscape	Distance from home or place of residence 0.200(*) Frequency of Play 0.257(**)		Distance from home or place of residence 0.190(*)
Service Facilities			
Recreation Facilities	Number of visitors-0.213(*)	When to visit 0.175(*)	
comfortable design	Dwell Time 0.240(*)		
Overall space	Frequency of Play 0.201(*) Number of visitors-0.225(*)		
Retrofit Intentions	Frequency of Play 0.238(*)		Set up along the trail 0.187(*)

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

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

As shown in Table 8, when we analyze the most significant cross-values of the landscape elements and behavioral activities within the three segments, we can see that the Hangzhou Riverside Section is the most distinctive. In the visual landscape, distance to home and frequency of play a huge role in determining the landscape. When the accessibility of the waterfront space is high enough, people will gladly come to visit the space. The cross-tabulation of comfort design and length of stay shows that people stay longer when the space is comfortable enough, but when the space is not comfortable enough, people quickly leave the space and have a wrong impression of it. Therefore, the comfortable design of a space is decisive for people's behavior in visiting it. The overall design of the space is closely related to the frequency and number of people who visit the space. The correlation between the design of the intention to transform and the frequency of play is also strong, indicating that whether people's intention to transform the space is realized or not can determine how often they come from the space.

Table 7-9 Relationship between comfort design and dwell time on the Hangzhou Riverside Section.

Comfort Design Items	Statistical Items	Typical length of stay here Correlation coefficients
Accessibility	Correlation Coefficient	0.149
	Sig. (2-tailed)	0.134
Pavement texture	Correlation Coefficient	0.275(**)
	Sig. (2-tailed)	0.005
Pavement color	Correlation Coefficient	0.176
	Sig. (2-tailed)	0.077
Pathway width	Correlation Coefficient	0.164
	Sig. (2-tailed)	0.099
Pathway route	Correlation Coefficient	0.167
	Sig. (2-tailed)	0.093

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

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

Here, we can extend the Comfort Design feature to include a cross-tabulation analysis of how long people usually stay in the space. It is evident from the data analysis that road surface materials have the strongest correlation with the amount of time people spend in the space, proving that transportation is the essential option in the design of comfort and convenience. Pavement materials have the most significant influence, so when pavement materials in the waterfront space and process traffic are comfortable enough, they create a better impression in the anticipatory phase of the space, thus making people form a better prediction of the waterfront space and deepening their impression of the activities in the space. The correlation between pavement materials and crowd retention is that the pavement materials in different areas have different sensory effects on people. The specific materials should be designed for the nature of the activities in the space, so that the pavement materials will give a hint and induce the activities in the space, stimulating the birth of appropriate crowd behaviors.

7.1.4 Activity

Behavioral activity is a non-physical response to a waterfront landscape space. It mainly includes the various activities of people in space, such as human activities, water activities, animal activities, etc. They are closely related to each other and affect each other. The close relationship between them and their mutual influence and integration with the surrounding environment constitute the urban waterfront landscape space, forming a characteristic of the space. People's activities are determined

by themselves, but space can inspire people to produce activities. So an adequate activity space can affect the type, frequency and time of people's activities to a certain extent. Space cannot determine whether people go to activities or not, but it can direct them to happen.

The level of energy generated by people in a space can be summarized as the overall activity of the space. Spaces with a high level of activity attract more people to interview, and different groups of people visit the space at different times of the day, which leads to various types of activities.

For example, the correlation between recreational facilities in the Hangzhou Canal segment and the behavioral activities of people when they come from the segment is obvious when we cross-tabulate them. The data are shown in the following figure：

Table 7−10 Cross-sectional analysis of the Hangzhou Canal recreational facilities and people's behavioral habits regarding when they come here.

Recreation Facilities Items	Statistical Items	When do you usually come here Correlation Coefficient
Children entertainment facilities quantity	Pearson Correlation	0.135
	Sig. (2-tailed)	0.065
Children entertainment facilities safety	Pearson Correlation	0.137
	Sig. (2-tailed)	0.062
Elderly activity facilities quantity	Pearson Correlation	0.214(**)
	Sig. (2-tailed)	0.003
Elderly activity facilities safety	Pearson Correlation	0.117
	Sig. (2-tailed)	0.111
Fitness facilities quantity	Pearson Correlation	0.157(*)
	Sig. (2-tailed)	0.033
Fitness facilities type	Pearson Correlation	0.168(*)
	Sig. (2-tailed)	0.022

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

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

In the cross-sectional analysis table, we can see that there is a significant relationship between the number of senior facilities and when people usually come to the facility. This means that the elderly are the ones who are more selective about when they come here because they have more free time in their daily lives and may have fitness needs at any time. Hence the number of senior facilities in the space directly determines when people usually come here.

Second, the number of fitness facilities also directly determines when people usually come to space for activity. Spaces with a higher number of fitness facilities are better able to attract visitors. They generate deeper interactions, thus increasing the vitality of the landscape space, which is also a guide for human behavior. A space with more fitness facilities can better attract people to visit and create a deeper level of interaction, thus increasing the liveliness of the landscape space, which is also a manifestation of the guiding nature of the space to human behavior.

Finally, the correlation coefficient between the type of fitness facility and when people come here is also high, proving that when there is a good variety of fitness facilities in the landscape space, they are more attractive to people. Different fitness facilities apply to different activity periods, so they have an impact on the time of people's visit.

To summarize the above data analysis, we can find that the vitality of the space can be enhanced through the addition of recreational facilities. The recreational facilities in the space have a better guide to people's activities and behaviors to a certain extent, which can change some of the habits and choices of people visiting the space and can encourage people to better integrate into the activities of the space so that the waterfront space is revitalized.

7.2 Fit of waterfront space

7.2.1 Publicity

In a city, publicity of any space for common activities exists in nature. Public space is a physical existence between urban buildings. It belongs to the public domain and it is a place where citizens can freely use urban facilities. It also contains a diverse social life. Therefore, the publicity in the waterfront landscape space is a characteristic of its development, and it is also an important factor that stimulates the vitality of the city and improves the quality of life of residents.

It must be attractive enough and the transportation must be convenient to create a public space that can attract the attention and participation of the crowd.

When planning and designing, the functions of the nearby facilities should be integrated, and the environment of the space should be diversified and suitable for outdoor activities in various weather conditions. Public transportation or pedestrian connections should be designed to connect public open spaces and users.

By analyzing the overall design of the space and the activity habits of a few people walking together, it can be found that there is a clear correlation between them. The analysis data is as follows:

Table 7-11 Cross-sectional analysis of the number of visitors and spaces in the Hangzhou Binjiang section.

overall Space	statistics	How many people correlation coefficient
great accessibility	Pearson Correlation	-0.300(**)
	Sig. (2-tailed)	0.002
City characteristics	Pearson Correlation	-0.118
	Sig. (2-tailed)	0.239
Government's attention	Pearson Correlation	-0.086
	Sig. (2-tailed)	0.391
Planning and Design	Pearson Correlation	-0.168
	Sig. (2-tailed)	0.091
user	Pearson Correlation	-0.162
	Sig. (2-tailed)	0.104
Personality	Pearson Correlation	-0.210(*)
	Sig. (2-tailed)	0.034
Quality of green belt in isolating freeway	Pearson Correlation	-0.248(*)
	Sig. (2-tailed)	0.012

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

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

Firstly, in the analysis of spatial unity and the relationship of several people walking together. We found the highest correlation between transport accessibility and the number of people walking together, confirming that the demand for public transportation is high in waterfront landscape spaces. As public transport becomes more accessible in the vicinity of space, more people are attracted to it, and the public and vitality value of the space increases. Therefore, transport portability is the most important factor in the public availability of space.

Secondly, the connection between the personal characteristics of the space and the number of people walking together is also high, which proves that when the cultural characteristics or style of

the space are unique enough, It also has a strong appeal to people. It attracts people to entertain in the space and increases the charm and flexibility of the space, making the waterfront space more integrated into people's daily lives and a part of everyone's lives.

Finally, there is a high correlation between the planning of the barrier and the number of people walking together, demonstrating the need to pay close attention to people's privacy when they move about in outdoor spaces. This privacy is more about the feeling of safety when moving around in outdoor spaces, which is an added value given by the public nature of the space. People develop more trust, which in turn enhances the scale and frequency of their activities in space when the public dominates the space. The spatial separation can also be planned with soft plant enclosures, which not only ties the public spaces together but also ensures the independence and outdoor security of each space.

In summary, the public of the waterfront space is an essential prerequisite for people to entertain within the space, as well as a perception of the convenience and reliability given to people. In addition, publicness is a significant spatial characteristic that ensures the normal movement of people and stimulates them to have deeper experiences.

7.2.2 Participatory

The design of urban waterfront spaces should have a positive interaction with the surrounding urban land and should be closely related to the needs of visitors and the history, economy, and culture of the site. Consequently, when designing a waterfront landscape, the first step is to investigate the natural and social environment, the current state of development, and the density of human activity in the area to determine the current status of the design and its positioning for future development. The waterfront landscape space should be combined with the local cultural traditions, recreational needs, and actively mobilize people's participation in the space so that the river system is truly integrated into the city life because each river has its own unique natural characteristics and each city has a different regional cultural characteristic.

Another important feature of the waterfront landscape space is the spontaneity and induction of activities. From superficial spatial behavior such as walking, admiring, and resting to deeper spatial activities such as communication, water play, and social feeling, behavioral needs support elements also show a gradual increase in the state, that is the latter needs to occur on the basis of the former. If these types of behaviors are collectively referred to as hydrophilic activities, they show a cascading pattern with the degree of closeness of the water. Since people tend to entertain and stroll in places where they can easily stay and watch, they need corresponding spaces to support them. The participation of a waterfront landscape space is a deeper landscape experience that is gradually

derived from people's shallow activities that interact with space.

The organizational role of design for the masses, on the one hand, shows support for the basic needs of the public. More importantly, the design presents an advocacy influence on the activities of people, which is a vital factor in inducing people to participate in the space. This leads to the progress of human activity in the direction of a higher quality of sociality. The design of waterfront landscaping spaces is primarily concerned with the organization of visitor behavior and activities. When space is restricted, it can only induce shallow activities such as strolling, watching, and so on. A wide range of behaviors can stimulate deeper water-friendly activities, such as socializing and interacting, thus making the waterfront space an effective part of the public's life and a vital part of the city center. Therefore, it is possible to increase the number of recreational and fitness facilities, which have a clear functional orientation, to increase people's participation in the space. Although such behavior promotion is based on the exploration and study of public behavior patterns, it can improve the quality of spaces and facilities, and proactively lead to certain behaviors.

The close relationship between the number of visitors and facility options can be found through the statistics of recreational facilities and visitors in the Hangzhou Binjiang area:

Table 7-12 Cross-sectional analysis of the number of recreational facilities and tourist in the Hangzhou Binjiang section.

recreational facilities	statistics	How many people Correlation Coefficient
Quantity of Children's facilities	Pearson Correlation	-0.199(*)
	Sig. (2-tailed)	0.045
Security of Children's facilities	Pearson Correlation	-0.175
	Sig. (2-tailed)	0.079
Quantity of senior facilities	Pearson Correlation	-0.119
	Sig. (2-tailed)	0.235
Security of fitness facilities	Pearson Correlation	-0.188
	Sig. (2-tailed)	0.059
Security of fitness facilities	Pearson Correlation	-0.211(*)
	Sig. (2-tailed)	0.033
Types of Fitness Facilities	Pearson Correlation	-0.226(*)
	Sig. (2-tailed)	0.022

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

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

From the analysis, it can be seen that there is a strong connection between the number of visitors and the facility options. The relationship between the number of children's facilities and the number of people accompanying them was significant, suggesting that children's facilities can, to some extent, influence the number of people coming to an activity, such as a family or a close friend. Therefore, the number of children's facilities is an important dimension for increasing spatial participation and enriching spatial vitality. At the same time, the number of workouts is also more closely related to the number of people walking together, highlighting the desire for outdoor sports or outdoor fitness in modern urban life. The number of fitness facilities is also a very important criterion for evaluating the participation in a space. We found that the type of fitness equipment has

a high correlation with crowd association, indicating that when there are enough fitness facilities in the space, they can also be used as landscape elements to induce people to come to space and participate in the space, resulting in strong spatial participation. To sum up, we can find that the participation of space is mainly reflected in the basic landscape elements and designed landscape elements in the space, all kinds of landscape elements are at different levels to induce the effect of crowd behavior, so as to increase the vitality of the space.

7.2.3 Boundary permeability

Another characteristic of waterfront space is the softness of its boundaries. In the history of cities and water systems, the presence of a water system has changed the shape of the city. Due to the presence of water, bridges inevitably connect the two shores, and water rivers meander through the city's territory, enriching the city's contours.

In the process of the evolution of the water system, the city gradually formed a strip of space along the water on both sides of the city, shaping a unique urban structure distinct from the central space of the city. In cities, as the direction of the water system changes, the flow of water inevitably affects the planning of roads, the traffic network and other spaces in the city will undergo different attitudinal shifts as the water system bends and changes direction. As a result, the area shaped by the water system has a pronounced softness of boundary. The integrated functionality of the waterfront space is highly connected to the rest of the city, and the spatial boundaries are gradually diluted without any obvious separation. Given the range of activities people like to do and the multi-functional nature of the space, people are more likely to come to the waterfront to do activities.

The relationship between the water and the city is very close, in order to determine the landscape positioning of the waterfront space, it is necessary to conduct a detailed study of the city's rivers, combined with the city's cultural characteristics of the positioning. In addition, space should also be integrated with urban architecture, green space, traffic landscape, and consider the structural characteristics of urban water systems and green space in many aspects, on the basis of standardized construction, the water system landscape and water culture integrated into the city's cultural characteristics. Regardless of the form of the water system, or the network of water, or living with water, different functional areas of the city should show their own characteristics. The multilayered water system form provides a solid natural foundation for creating a multi-level urban landscape. For the integration of urban cultural resources, it is significance that the combination of water systems and urban culture and clear positioning of the city's water landscape is in increasing the value of tourism development, and it can accelerate the formation of city brand characteristics, and enhance the city's identity.

People living on hillsides and with water dates back to ancient times. The shaping of the city's waterfront space is closely related to the city's water culture, and the urban structure is judged by the urban water system to achieve a good framework for the urban water system in the planning stage. Urban water systems are shifting from monolithic protection to conservation use. The water system will shift from passive protection of the urban spatial structure to dominating the urban spatial structure and providing guidance to other special plans in the city's master plan.

7.3 Transmission of civilization

7.3.1 The media between modern and traditional cultures

At any time in history, people's activities in the waterfront space will become the memory and then pass on, but the connection between human activities and the space is eternal. The influence of the past on the present is inextricably linked through the historical study of the waterfront landscape. There is a logic of necessity that is not only historical and modern but also future. We are aware of the influence of history on the present, but we must also be aware of the influence of history on the future. The modern age is the heritage of the past, and the future is the inheritance of the present. The waterfront landscape is characterized by its intrinsic relationships, which reveal the structure between buildings, plazas, roads, and water. Although the function of the space may change over time, either as a renaissance or as a return to tradition in a new form, the intrinsic properties of the waterfront landscape space are defined. People can explore the historical past in a space that preserves history in a spiritualized form. People can feel the traces left by the times in the space, and feel the history left behind without passing any language.At the same time, space also preserves traditional culture or traditional things and modernizes them in a new way, enabling people to dialogue with history.This is an extension of the cultural lineage of the space and its penetration into modern life.

The historical and spiritual culture of the waterfront space impact the way of life of modern people. Activities in traditional spaces have been passed down from generation to generation so that their cultural essence can be presented in a new era, which is the spiritual wealth that space gives to mankind. Besides, waterfront spaces are an important bridge between history and modernity. In the long river of evolution, the activities of predecessors drive the subsequent development, and space also leads to the thinking of the future generations about history. Space acts as a medium in the process, bridging the gap between tradition and modernity, and is an important vehicle for the transmission of spirituality and activities.

7.3.2 Spiritual support

According to the previous analysis, publicness is the most important element of the waterfront landscape and an important feature of the spatial development of the waterfront landscape. In order to achieve this public nature, it is necessary to first gather people's collective memory of the urban waterfront space based on the realization of this external spatial form. The key to creating a vibrant urban waterfront landscape space is through the transmission and integration of collective memory. We could design a kind of spiritual sustenance in a waterfront landscape space, where any event that occurs is recorded and memory is formed in people's minds. When people come back to the space to engage in activities, it will trigger a recollection. This is a reflection of the emotions people place on a certain space in the city, and the waterfront space, as a natural landscape space adjacent to the water system, has such a carrying capacity.

In the three waterfront landscape spaces analyzed in this paper, the main elements of space are linear public spaces such as urban public squares, parks, tourism spaces along historic waterways, marinas, and architectural plazas. The linear public space is a public space in terms of land use attributes, characterized by the multiple functions of gathering and entertainment for citizens, a form of activity that contributes to making the space a lasting memory of the city. People experience the spaces while they form and organize the urban waterfront, creating a strong and prominent image of the landscape, reflecting the style of the city and the richness of its history. Waterfront landscape spaces have historical heritage because they are large and public, with many visitors, and follow many urban cultures and few spatial changes. The trajectory of activities in the space and the traces of the development of the space itself will become history, engraved in the space. The spiritual culture which subtly changes the form of the space and has some influence on the orientation and direction of the development of the space embodied by people's activities in a place is a kind of attachment of people to space.

Waterfront space is different from other built spaces in the city. It is not a completely artificially constructed physical space, and its natural ecological properties are very distinctive features. Some areas were designed with human involvement, but they were also modified based on natural landscape patterns. As early as ancient times, there were rural gardens in the countryside, and in modern times there are artificially created natural habitats or specially protected wetlands. Therefore, the naturalness of its space will make people have a more intimate sense of experience. People are more willing to entrust themselves to the natural environment, so the spirit and emotion for the waterfront space are stronger. People are more willing to empty themselves in such an eco-environmental space, return to their true nature, and place their thoughts and emotions in the space. As a result, the waterfront landscape becomes a spatial container for people's thoughts, environment,

and emotional memories. Such a spatial container can carry unchanging memories in the course of time, for people to recall, especially in the more historical and cultural waterfront space. The landscape space based on the traditional water system has its own strong cultural atmosphere, and people are more willing to use it to express their own feelings, such as the waterfront landscape space of the Hangzhou Canal Section and the Shaoxing Ancient Canal Section analyzed in the text. Looking back at history, we find that countless writers and scholars have expressed their emotions in these two waterfront spaces, resulting in numerous poems that have gone down through the ages, describing the beauty of the space and expressing the deep feelings of the present. This is another important charm of the waterfront space——the cohesion of people's thoughts, rendering the current feelings of a special space carrier.

Analyze data on the cross-correlation between the intention to transform the waterfront landscape space and the frequency of play in Hangzhou's riverside section. People's opinions on spatial improvement are mainly reflected in the creation of a cultural atmosphere, and the results are as follows:

Table 7-13 Cross-tabulation analysis of intention to renovate Hangzhou's riverside section and crowd play frequency.

Remodeling Intentions	Statistics	Play Frequency Correlation Coefficient
Additional resting places	Pearson Correlation	0.224*
	Sig. (2-tailed)	0.024
Adding the Theme Square	Pearson Correlation	0.217*
	Sig. (2-tailed)	0.028
Adding guided tours	Pearson Correlation	0.222*
	Sig. (2-tailed)	0.025
Additional commercial facilities	Pearson Correlation	0.175
	Sig. (2-tailed)	0.078

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

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

As a newly built waterfront landscape space, the cultural connotation of the Hangzhou waterfront

section is naturally weaker than that of the Hangzhou and Shaoxing canal sections. In this space, people can experience the convenience of modern life and perceive the vitality of public space, but the only thing missing is the perception of the cultural nature of the space. Therefore, we can see from the survey on the intention to renovate the space that people's intention to renovate is mostly to deepen the culture of the space and to unite the spirit of the place.

The three indices with the highest correlation between intention to transform space and frequency of play were the options of adding open space, adding themed plazas, and adding tour buses. Firstly, in terms of increasing rest space. According to the field survey, most of the existing rest space is relatively quiet, the vitality value of the shaped environment is low, the space material is relatively hard, people more hope to increase can reflect the cultural atmosphere and emotion of the soft space. Secondly, there is a high demand for additional themed plazas, and the thematic nature of the space is an important element that can help people render emotions and express their feelings. In a thematic space, people will increase activities and thoughts related to the theme, and carry out content related to the theme, thus generating emotions that rely on the space. In adding guided tours, there is a desire for a vehicle that connects the content and ideas within the venue, and that allows for communion and empathy within the space. All of these are based on field research, a desire for the spirit of place and an expectation for the development of human culture in waterfront spaces.

7.3.3 Supporting premises for future space turnover

The development of a city records its history and preserves the culture of the place at the same time. The resources of the city's historical and cultural landscape represent the activities and concerns of early mankind, reflect the course of cultural development, and they are the traces left by the city in the process of development. Nowadays, modern transportation industry replaces the traditional water transportation mode, and the historical and cultural resources around the urban water system are diluted, losing the connection with the original urban human network, thus weakening its landscape value.

The urban water system enjoys a beautiful natural location in the urban space because of its unique geological conditions and human environment. Urban water landscape layout features not only focus on the structural features of the water system itself but also integrate the landscape resources around the water system space to combine the water system landscape construction with the city's historical and cultural preservation. We should pay attention to the construction of green landscapes in water systems, for example, at the level of the water system structure to show the local human characteristics. The development of water landscapes drives the development of urban tourism and promotes the integration of regional waterfront ecotourism spaces. Urban tourism space

is an organic complex composed of the natural landscape and cultural landscapes. The rich natural form of the water system greatly enriches the landscape resources of the tourist places, and the history and culture of the tourist places also deepen the cultural connotation of the water landscape system. The unique fluidity of the water system, the openness of the landscape, the diversity of the landscape composition and the specificity of the water activities provide space for the implementation of a regional waterfront tourism architecture.

There are two main modes of regional waterfront landscape space extension, the point-axis development mode with the river as the integration axis, and the radiation mode with the lake as the overall core. Both of them are regional cultural presentations based on water systems. In the point-axis development model with the river as the axis of integration, the space is distributed in bands. The river is divided into blocks to create a regional mini-cultural gathering, which presents a unique cultural landscape in different areas and combines with the local spatial patterns and folklore, thus integrating all parts of the culture into a water context and influencing the urban space as a whole. The cultural development circle centered on the lake expands radially from the center to the periphery, and the closer the waterfront landscape space is to the lake, the stronger the cultural attributes become, and gradually expands outward to integrate with modern city culture. Either of these two forms plays a decisive influence on the construction and development of future urban space. They are the supporting prerequisites for the development of future space and the basic background for the cultural characterization of future space.

The urban water system, as an important prerequisite element in shaping urban space, has an objective influence on future space. the nature of the current space will not change significantly in the future, and the main focus is based on the optimization and improvement of the current space. The current vitality of the space is also an important prerequisite for the future development of the space. Only if the current space is highly active and people are willing to move around in it, can we discuss the future development of the space and its future orientation. The context plays a very crucial role. The culture of space is an important indicator of how space functions and shapes its style. It is also an important element in people's choice of whether or not to engage in activities in the space.

7.4 The relevance of urban economic industry and waterfront space

Industrial development promotes the birth of cities, and urbanization continues to gather various elements to further promote industrial development. The industry is the support of urban development, and city is the carrier of industry promotion. The development process of industry and city mutually cause and effect. Therefore, the relationship between urban industrial economy and

urban space shaping is inseparable.

Waterfront space is the main space for urban economic development. Historically, many seaport industries have been accompanied by water, forming an urban economic development area with urban waterfront space as the main carrier. With the gradual development of cities, this type of industry-leading functional area gradually retreats from the main urban space to the suburbs of the city, returning the vitality of the waterfront space to the public. As a result, the waterfront landscape space gradually extends. In this process, the waterfront space completed the whole process from economic support to landscape support.

7.4.1 Scale of waterfront space layout

The urban economic industry determines the scale of the spatial layout of the waterfront landscape. The spatial scale includes both spatial distance and spatial scale. If all kinds of spaces deviate from a reasonable spatial scale, it will inevitably lead to disorder in spatial relations. Therefore, the impact of urban economic industries on a spatial scale is decisive. In the process of rapid urban development, if the spatial layout of the machine is based on the idea of functional zoning, it will lead to too concentrated population density or too single-function residential communities. The inefficiency of urban operations such as tidal traffic. Improper grasp of the scale of space will also lead to inconsistent space, low land-use efficiency, and inconvenient use of functions. Therefore, in the waterfront space, the urban economic industry controls the scale of the waterfront landscape space from a macro perspective.

For industries with better economic development, the design of waterfront landscape space often pays more attention to the vitality of the city and the city’s smart technology. The overall scale of the space is too large, hoping to reflect a grand urban landscape, and Most of the space layout is relatively empty, with a large amount of public activity space, which can carry more people to carry out intensive activities in the space so that the crowd can experience and appreciate the city's entire shoreline style and city night lighting visual exhibition.

In the waterfront landscape space of the old city along with the ancient water system, the spatial layout scale is optimized based on the original ancient spatial form. Therefore, the spatial layout has certain limitations in nature. The development of industry and economy is more dependent on the development of the tertiary industry carried out by the tourism industry, so its economic development method is relatively soft. More is to influence and shape the layout scale of waterfront landscape space from the aspect of culture and economy.

Among the waterfront landscape spaces that are yet to be developed or on a smaller scale, such

as the waterfront landscape space of the Shaoxing Ancient Canal section studied in this article. Due to the limited urban scale and limited population of Shaoxing City, the overall urban economic development is quite different from that of first-tier cities. The tourism industry is not yet fully mature, and its impact on the waterfront landscape is relatively weak, resulting in existing spatial functions. Relatively simple, the spatial layout and scale are still in a relatively primitive, low-development state.

From this, we can see that among the three types of landscape space, the impact of the urban economy is very obvious and decisive. It positions the layout of the waterfront landscape space and at the same time directly shapes the layout of the economic structure and economic development goals. The scale of the waterfront space.

7.4.2 Qualitative function of waterfront space

The traditional urban functional zoning is to strictly classify the urban land according to different functions in the geographical space, and carry out zoning construction, and each district realizes the corresponding function, to solve the urban problems such as scattered urban layout and chaotic function distribution. Overall, the independent development of each functional area blocked the organic connection between urban functions [24]. Therefore, we will find that in the process of urban development, the functions of its various parts are integrated and interpenetrated with each other, especially the comprehensive urban functional space. Every function of people's daily life must be condensed in this space. As the city's unique waterfront comprehensive space, its function also changes with the development of the city's economy.

When people used water to come and go for industrial production at the earliest, the urban waterfront space was mainly used as a wharf to undertake passenger and water transportation and other transportation functions and storage functions. This is the shaping of the functionality of the waterfront space by the economy in the industrial age. With the development of the times and the advancement of transportation tools, most of the urban industries have gradually retreated from the waterfront space to the suburbs of the city. In the waterfront space, people have reproduced the natural vitality that is close to the water system. The waterfront space has gradually become a living activity space for residents' daily activities and natural customs.

For example, in the waterfront landscape space of the Hangzhou Riverside section, the obvious characteristics of connecting urban space functions with urban economic development are shown. The Binjiang District of Hangzhou takes high-tech economic industries as the main pillar economic industries in the urban area. Most of the areas in the area are emerging industrial parks and newly built residential areas. The landscape and cultural atmosphere of the entire area is the vitality of the

new city. With vitality, in the waterfront landscape space of this section, the function of the landscape space is mainly shaped around the needs of residents' daily life, and it also shows the emerging industries in the region, condensing many intelligent industrial elements, reflecting Emerging technologies in cities. Walking in the waterfront landscape space, you can feel the fresh urban vitality in the area.

In the waterfront landscape space of the Hangzhou Canal section, the economy in this area is mainly a tertiary industry with tourism as its mainstay. Most of the functions in the space are carried out around the development of tourism, and there are more service-oriented industries. Therefore, in the waterfront landscape space, its function is dominated by the service for residents' daily life and the service for tourists' travel needs. The layout scale and overall and partial functional elements in the space are all centered on tourism services.

In the waterfront landscape space of the ancient canal section of Shaoxing, due to the limited overall economic development of the city, the impact of urban economy on the waterfront landscape space is relatively low. There is no characteristic economic industry pillar in the area, and there is no strong economic support. The development of the waterfront landscape is at a stagnant stage and only meets the daily needs of the surrounding residents. The development of space tourism and the reflection of urban cultural features need to be further clarified.

7.4.3 Clarification of the city's comprehensive positioning

As the gateway to the city, the urban waterfront space is a business card for the city to display. The influence between the positioning of the city and the waterfront landscape is mutual. The waterfront culture can shape the space and cultural positioning of the city to a certain extent. Similarly, the future development positioning of the city will also affect the changes in the waterfront space. The two influence each other and jointly promote the development of the city. In the urban waterfront landscape space with a larger water system, its cultural connotations are more derived from the cultural heritage of the water system itself, which is the cultural tone set by the city since its formation. In the process of urban development, the traditional water culture and the emerging development culture of the city are integrated, and gradually condensed and integrated into the overall positioning of the city. For example, in the urban agglomerations surrounding the Taihu Lake Basin in Jiangsu, the cultural development is based on the extension of the Taihu water culture, and the positioning of urban development is also carried out based on this water culture. Until today, the comprehensive development and tourism development of the city is still Sublimation around the culture of Taihu Lake.

In the three sample areas studied in this article, the waterfront landscape space of the Hangzhou

Binjiang section relies on the emerging development technologies and high-tech industries of Hangzhou Binjiang District. The design positioning of the overall waterfront landscape space is to optimize the residents' lives and serve the residents' daily urban integrated service space. Therefore, in planning and design, most of them pay more attention to the convenience, service, publicity and vitality of the space, in order to maximize the outdoor activities that serve the crowd. Integrating with the overall development positioning of the Binjiang District, people can not only feel the charm of water culture in the waterfront landscape space but also the convenient vitality of the emerging urban area.

In the waterfront landscape space of the Hangzhou Canal section, the waterfront landscape space extended by the ancient Beijing-Hangzhou Grand Canal has carried people's yearning for natural and productive landscapes from ancient times to the present. Positioning this area as the main tourist area in the urban comprehensive area, and space is mainly positioned as a tourist viewing space and a tourist service space. Its spatial form is more pleasant. The industries, functions, forms, and scales in the space are all based on viewing. Mainly carry out planning and design. Walking in the space, people can experience the historical and cultural heaviness brought by the profound canal culture. In the waterfront landscape space, many sculptures and historical relics are describing the development of the Beijing-Hangzhou Canal to show visitors preservation of the complete canal historical waterfront landscape cultural space.

In the Shaoxing ancient canal section, its water system is a branch of the Beijing-Hangzhou Grand Canal, and the canal culture is also circulating. The waterfront landscape space that accompanies the canal retains a large number of processes related to the production and transportation of the canal water system, and the original form of the space is also formed based on the production activities of the canal, including the famous ancient fiber road and related ancient bridges. Describes the grand scene of canal production at that time. At this stage, the waterfront landscape of the Shaoxing Ancient Canal section is positioned to serve the living space and tourism space of residents and tourists. However, due to the limited urban development, the support for tourism development is far from enough. Therefore, space needs to be optimized, and stronger economic support is needed to complete the renewal of the spatial form and the shaping of the culture.

7.5 The relationship between behavior, space, culture and economy in waterfront space

7.5.1 The four elements form a whole

Crowd behavior, space ontology, cultural heritage and economic industry in urban space are interrelated to form a whole, which together shapes the form of space, determine the function of

space, and enrich the culture of space. Especially in the urban waterfront landscape space, its characteristic of being accompanied by water determines that it is a complex of function and landscape. People's activities have an impact on the space, feel the cultural atmosphere in the space, and at the same time accompany the occurrence of economic activities. Through the virtuous circle between behavior, space, culture and economy, to create a comprehensive space for the city that is more in line with people's life needs and the future development direction of the city, which is determined by the internal logic of urban development.

7.5.2 Interpenetration among the four elements

Among the four elements in the urban waterfront landscape space, space provides place support for the crowd. Only with space can it accommodate crowd activities, form social interactions and promote social development. Therefore, crowd activities are the basis for the healthy development of space. In the process of activities, space affects the activities of the crowd, such as the scale, form, and function of the space, which directly determines the content of crowd activities to a certain extent.

At the same time, crowd activities will also affect the form and function of the space to a certain extent, thereby changing the development direction of the space. For example, the function of the parking lot is transformed into a market, which is the transformation of space function by people's activities.

Secondly, regional culture is the guarantee of space development. Any space has its clear cultural attributes to position the future development target of space. In the process of space development, regional culture determines the development content of space and the development situation of space. Transform into industry, and then promote the vitality of space economy.

Finally, the economic industry is the support of spatial development. The economy in space is the prerequisite to support the development of space and material support for space development. At the same time, the economic content in the space can also attract more people to space, triggering a series of behaviors to stimulate economic development, enhance the vitality of the space, and optimize the shaping of the space.

Therefore, we can develop that the behavior, culture, economy and space ontology in the urban waterfront space is interconnected and permeated with each other, and together they form a complex waterfront landscape space.

Reference

[1] Qing Fang, Puhua Bu. Urban Waterfront Recreation Space Design Study , The Planner [J].2003:9（46-49）.

[2] Richard Marshall.Translated by Yongjie Sha. Urban Design in America [M]. China Construction Industry Press 2004.1:58-61.

[3] Yisan Ruan, Meng Sun. Some Problems of Historic District Protection and Planning in China [J]. Urban Planning,2001,5:25-32.

[4] An Byung chul. An Importance and Satisfaction Analysis for Improvement Efficiency Use of Waterfront - A Focus on the Waterfront Analysis for Domestic and Foreign Dragon Boat Festival. 2016, 44(4):86-99.

[5] Yulian Lin、Zhengfan Hu，Environmental Psychology Beijing [M].China Construction Industry Press，1989.

[6] Lee Yeon So, Kim Choong Sik, Choi Gi Su. A Improvement Scheme for the Illumination of Surrounding Lake Scenery in a Historic and Cultural City - Focusing on the Bomun Lake in Kyung Ju City -. 2011, 29(1):142-156.

[7] Jie Li, Xiang Ying Zhang. Public Landscape Regeneration Design Strategy in the Old City Reconstruction Based on the Restoration Ecology. 2014, 3593:505-508.

[8] Wen Hui Zheng. Study on Conceptual Planning of Waterfront District in Hanyang. 2011, 1366:167-170.

[9] Changliu Wang, Xiaojiang Xia, Dejie Deng. The Application of Ecological Cycle Theory in Waterfront Area Design. 2018, 394(5).

[10] Masaaki Okada, Koichi Nakama, Yoshio Nakamura. A Study on the Transition of Civil Image Toward Industrial Waterfront in Keihin Industrial District. 1995, 23:32-39.

[11] JohnB.Best . Translated by Xiting Huang. Cognitive Psychology [M]. Beijing: China Light Industry Press，2000.

[12] Lisa S. Krimsky, Mary G. Lusk, Holly Abeels, et al. Sources and concentrations of nutrients in surface runoff from waterfront homes with different landscape practices. 2020.

[13] Miranda McMinn, Scott Kirsch, Donald McNeil, et al. Review: Consuming Tradition, Manufacturing Heritage: Global Norms and Urban Forms in the Age of Tourism, Hybridity and its Discontents: Politics, Science, Culture, Waterfronts in Post-Industrial Cities, Manufacturing Montreal: The Making of an Industrial Landscape, 1850–1930, Skateboarding, Space and the City: Architecture and the Body. 2001, 33(11):2083-2088.

[14] Weiya Zhang. Synthesis of Cultural Heritage Research on Urban Historic Sites [J] Journal of Southeast University,2007,12:162-165.

[15] David C. Sloane. Review: A Negotiated Landscape: The Transformation of San Francisco’s Waterfront Since 1950 By Jasper Rubin. 2018, 38(1):117-118.

[16]Xiangrong Wang,Qing Lin，The Theory and Practice of Modern Western Landscape Design [M]. China Construction Industry Press，2002:43.

[17] Shaohui Ren. The Application of Behavioral Psychological Factors in Interior Design [M]. Meiyuan，2008.

[18] Xiumin Zhao. A Quantification Analysis on Acoustic Landscapes of Waterfront Scenic Areas:

2009, 8(2):379-384.

[19]Kaikai Yang, Research on Landscape Spatial Scenarios in Urban Waterfront Areas (Master's Thesis). Changsha: Zhongnan University,2011.5.

[20] Benson E. Rivers as urban landscapes: renaissance of the waterfront. 2002, 45(11):65-70.

[21] Zheren Dong. Principles and Techniques of Ecological and Hydraulic Engineering [M]. China Water Conservancy and Hydropower Press,2007.3:289.

[22] Xin Qun Feng, Chen Du, Xiao Dong Liu. Design & Research of the Traditional Waterfront Interface Houses in Shanghai Ecological Transformation - Pudong Ancient Shao Jia Lou Town House. 2012, 1792:2667-2673.

[23] Gui Yuan Li, Zhong Yuan Duan, Yang Xu. The Discussion on the Construction of City Waterfront Landscape Based on the Visual Angle of Ecology Restoration. 2011, 1269:6827-6833.

[24] Yifan Yu. Waterfront Space Improvement and Use of the Seine River in Downtown Paris. Overseas Urban Planning,2004,5:85-87.

Chapter 8

SUMMARY AND OUTLOOK

CHAPTER EIGHT: SUMMARY AND OUTLOOK

8.1 Conclusions

As an integrated activity space, the shaping process of urban waterfront space combines people's sense of use, spatial compatibility, contextual penetration, and economic impact. The four are interrelated, and together they shape the form, function, culture, and development orientation of the waterfront space.

As a user of a site, a person's perception of space is direct. The activities of people in an area produce different sensory effects and other impressions of the room as they move from place to place. This is an integrated experience based on the use of space. First of all, under the sense of function based on the integrated experience, the specific activities in the site and the applicability of the tasks in the area are important aspects of the crowd's experience. Different facilities in the space, including plants, landscaping objects, guidance systems, etc., are the landscape elements that together constitute the function of the waterfront. In the process of using the parts, people feel the support from the space in terms of convenience, and at the same time, they also experience the beauty of form and culture contained in the space. The visualization and rationalization of these functions can enhance the unique landscape style of the waterfront landscape. Secondly, the comfort and convenience of the waterfront landscape space is also an important prerequisite for shaping the vitality of the space. The external and internal accessibility of the waterfront space can improve the efficiency of using the waterfront space， at the same time, provide the place with better comfort. The function of facilities, pavement materials, scale and proportion, and flow planning all contribute to the comfort and experience of people. As a result, people will have a comprehensive judgment based on the ease of transportation, accessibility, and comfort to decide whether or not to arrive at a waterfront space for activities. Finally, the vitality of the space is also an important indicator of the comfort of the waterfront landscape space. People carry out a variety of activities in the space, and the relatively close relationship between them and their surroundings complements the character of a space. On the one hand, people's activities in space are subjective activities, and on the other hand, they are activities induced by space, which are given and provided by space and can be learned.

Space is an essential spatial support for people's behavioral activities. Hence, its public nature exists on its own, with a certain degree of functional complexity maintained around the space, a variety of internal environmental design, and the ability to adapt to a variety of climatic conditions for outdoor activities. Simultaneously, public nature should satisfy the need for easy access and internal pedestrian access. The overall spatial integrity of the space is positively correlated with the idea of several people walking together and the planning of separation zones, proving that the public nature of a space can be shaped by the space on the one hand, and brought about by the use of people

on the other. Secondly, the participatory nature of the waterfront space is also an important factor in shaping the vitality of the space, which allows it to have a positive interaction with the surrounding urban land, the needs of visitors and the history, and the culture of the surrounding site. The integrated elements of the space have a specific influence on the activities of the crowd, which encourages people to connect with the activities of the space, and induces deeper participation in water activities and social activities on the superficial level of viewing behavior, thus enhancing the participation and vitality of the space. Finally, one of the characteristics of the waterfront landscape space is the softness of its boundaries. In the process of development, the water system gradually forms the ribbon space on both sides of the city, shaping the unique spatial texture of the city. Throughout the region, the water system space is connected to the town by the waterfront. Therefore, the landscape space of the waterfront is a transition space from natural elements to artificial elements of the city, in which there is no apparent urban boundary, nor is there an obvious boundary of landscape elements, urban culture and natural culture are gathered in the space at the same time. The softness of its physical edge also shapes the cultural integration of spiritual and immaterial dimensions.

The development of waterfront landscape spaces is inherited, and the relationship between people's activities in the area and its form is timeless. The influence of past actions on the area has shaped the unique structure of space, and the existing spatial form also creates the current form of people's use of space and activities. Therefore, the waterfront landscape space is a vast landscape space that is oriented to history, modernity, and the future. The spirituality of the space also influences the life of modern people, and the cultural essence contained in the distance is passed on from generation to generation. It is a vital medium connecting tradition and modernity. At the same time, the public nature of the waterfront landscape space shaped by this outward landscape space form will make people have a collective memory of the space. This collective memory induces people to have a spiritual dependence on the place, making people place their emotions in the urban space. And the combination of artificial and natural elements in the waterfront landscape space is more likely to arouse people to express their feelings and sensations, generating strong emotions and realizing the sympathy with the place. Finally, the development of waterfront landscape space is based on its geological and human conditions and superior urban space location to have a decisive impact on future development, is the support of future spatial construction and development of the city, the premise is also the basis of the future space culture characterization.

The development of waterfront space is closely related to the economic and industrial development, the waterfront landscape space as the city's main comprehensive space, the city's level of growth and economic strength has a decisive influence on the shaping of the space as a whole,

especially the scale of the waterfront space layout shaping. Different city development level and economic level will construct different waterfront landscape space. At the same time, because the development of waterfront landscape space is continuous, the original spatial form has laid the foundation for the subsequent spatial development, and during the period to play a major role in the spatial expansion is the city's economic level. Secondly, the economic level of the municipality determines, to a certain extent, the characterization of the function of the waterfront space. In each period, the urban waterfront landscape space has carried different functions, which is a specific attribute given to space by the development of the times. From the industrialized canal trade to the modernized landscape socialization, these are the social roles assigned to the waterfront space by the economic development of the city in the current era. Finally, the urban waterfront space is also a manifestation of the city's comprehensive positioning. The style and culture of the waterfront space concentrate the development level of the whole city, and the shaping of the space is also gradually condensed in the process of urban development and the comprehensive positioning of the city as a whole.

In the process of integrated development of waterfront space, these four elements form a whole and come and go to form a driving force for the development of space. Through the behavior, space, culture, and economy between the formation of a virtuous circle of development. Through the virtuous circle of development between behavior, space, culture, and economy, we can shape the waterfront landscape space that is more in line with people's needs and the future development direction of the city. At the same time, these four elements permeate and influence each other. Space provides place support for people; activities of people influence the form and function of space to a certain extent; regional culture, as a guarantee of the connotation of space development, influences the character and position of future development of space; economic industry, as the strong support of space development, is the prerequisite foundation of a positive development of space. As a result, they work together to form a comprehensive waterfront landscape space.

8.2 Innovation & importance

8.2.1 Identify important attributes of waterfront space

This study is based on a large number of data surveys, field surveys, and questionnaires distributed in three typical areas to obtain primary data.

Based on the data-based analysis, we analyze the correlation between each part of the current waterfront landscape space by studying the relevant theoretical content and real cases. The four

most important supporting elements of the waterfront landscape space - behavior, space, culture, and economy - are derived from the theoretical research, which realizes a two-way transformation analysis from the academic research to practice. Therefore, this study is supported by both theoretical and practical data and is a complete research framework supported by both theoretical and practical data.

8.2.2 Propose a new finding of urban waterfront function

In researching the waterfront landscape space, through the original raw data and relevant theoretical research, the functional attributes of the urban waterfront landscape space are categorized in four directions: behavior, space, culture, and economy. It can play a guiding role in future research.

Within these four distinctive categories, the functional activities that people can perform in the waterfront space and the support and activity induction that the waterfront space provides based on the people's movements are analyzed in terms of behavior. In the study of the ontology of the waterfront landscape space, the comfort provided by the space, the compatibility of crowd activities, and the vitality of development are analyzed. At the cultural level, the development of the waterfront landscape space is traced back to the shaping effect it has had on the space in the course of its development and the close influence of the cultural factors accumulated in the process on modern life. As well as the important role of culture in the waterfront landscape space and its decisive role in the overall urban landscape and future development positioning. Finally, the connection between waterfront landscape space and urban economic development is analyzed. The development of the space is largely influenced by the socio-economic strength of society. Therefore, the satisfaction of the population with the facilities in the space, the satisfaction of the spatial form, and the satisfaction of the cultural penetration of the space are all influenced by the economy to a certain extent. At the same time, the economy also intervenes to a certain extent in shaping the future development of the space, enabling the urban waterfront landscape space to be presented as a gateway and business card to the city. This is one of the innovations of this paper, which is based on a large number of theoretical studies and data analysis of the four important influencing factors of waterfront landscape space and analyzes the relationship between each of the four factors and the development of waterfront space.

8.2.3 Perfect the design theory of urban waterfront space

This paper's third innovation is to build a theoretical framework for the spatial influence of urban waterfront landscape elements from four aspects: behavior, space, culture, and economy. From the

perspective of theory combined with practice, the study breaks through the conventional perspective of material level planning, taking material space as the basis and combining soft factors such as spiritual factors, activity factors, economic factors, and cultural factors to give key suggestions for urban waterfront landscape space planning, to improve the urban planning system further and promote the optimization of urban waterfront landscape space from quantity to quality. The research's content broadens the theoretical research, deepens the depth of the research content, and promotes the extension of the disciplinary theory of urban waterfront landscape spatial background. It is also of some reference significance for the study of other public spaces in the city.

8.3 Research limitations and perspectives

8.3.1 Research limitations

This study will cover mainly Hangzhou and its surrounding areas, and the scope of the course is relatively limited, as it cannot generalize many space types. The urban waterfront spaces cannot be classified into more features. Therefore, in the next research, we will continue to expand the coverage of the study, such as the Yellow River Basin, the Pearl River Basin, and other famous water areas as representatives, to carry out research and comparison of the urban waterfront landscape space within the region, to discover the characteristics of the regional waterfront landscape space, to reveal the combined influence of geographic and cultural factors on the urban waterfront landscape space. The comparative study of north and south watershed areas will reveal more apparent differences in regionalization of north-south urban waterfront landscape spaces and the different characteristics of spatial patterns, spatial structures, and crowd activities that they bring. Factors and influences.

8.3.2 The impact of the epidemic on research and strategies to address it

Due to the impact of the neo-coronary pneumonia epidemic, the number of active people in the region was much smaller than usual. The activities were limited, which affected the number of questionnaires distributed, and the number of useful questionnaires returned. The number of questionnaires distributed and the number of valid questionnaires collected were also affected, and due to the epidemic, people's activity behavior in the space also changed. However, with the improvement of China's epidemic situation, we have done additional research on the missing data from the previous survey. Yet, the amount of data still has room for expansion, We will continue to add more primary research data to demonstrate the more obvious interconnections between elements within the waterfront space.

At the same time, we will be looking for more ways to collect more complete and accurate data. For example, we will be collecting real-time data based on new wearable device systems that track a person's sensory comfort. People's movement in different spaces and the physical changes that occur in their bodies throughout the day determine the specific effects of their behavioral activities on the area. Through the wearing system or related app design, we measure the current blood flow, heart rate, blood oxygen, and other relevant data to determine the human body's current physical condition and use the biological data to judge the crowd's comfort with space activities. In this way, the research data can be collected through new and more cutting-edge technological methods.

8.3.3 Data analysis will be more diverse

The data analysis methods used in this study mainly rely on the software to perform statistics, correlation analysis between elements, significant factor analysis, and ANOVA, which can analyze all the data characteristics from a broad direction. However, we can continue to use more detailed data analysis methods to extract the detailed data of each part, such as ladder state, regression equation, etc., to find the potential hidden connections between the data. The analysis of the determining factors can be more detailed so that we can use more comprehensive data analysis methods to carry out further research.

The whole article aims to research from the perspective of use, to observe and analyze the way people use the waterfront space, the use of behavior, the use of feelings and the bi-directional influence on the space, to build a theoretical framework of spatial influences on the waterfront landscape, to analyze the four main influencing elements of behavior, space, culture, and economy in the waterfront landscape space, and to elaborate the relationship and influence between the four elements, for future waterfront landscape planning provides a dual perspective of material space and non-material elements, to provide reference and reference significance for other cities and regions.

Reference

[1] Guxi Pan. History of Ancient Chinese Architecture (Volume 4) [M]. China Construction Industry Publications, Beijing,2001

[2] Treb, Ding Liyan. Modern Landscapes. A Critical Review [M]，Beijing: China Construction Industry Press，2002

[3] Michael Batty, Ray Wyatt, Muki Haklay, et al. Review: Fluid City: Transforming Melbourne's Urban Waterfront, GIS, Environmental Modelling and Engineering, Landscape Simulation Modeling: A Spatially Explicit, Dynamic Approach, Profiling Machines: Mapping the Personal Information Economy, Surveillance as Social Sorting: Privacy, Risk and Digital Discrimination, Dialogues in Urban and Regional Planning 1. 2005, 32(2):305-316.

[4]Xiangrong Wang、Qing Lin，The Theory and Practice of Modern Western Landscape Design [M]，China Construction Industry Press，2002:43

[5] Value Capitalization Effects of Golf Courses, Waterfronts, Parks, Open Spaces, and Green Landscapes—A Cross-Disciplinary Review. 2016, 8(1):62-94.

[6] Agustina Martire. Imported and translated landscapes: Buenos Aires nineteenth-century waterfront parks. 2012, 32(4):258-276.

[7] Nik Luka. Contested periurban amenity landscapes: changing waterfront ‘countryside ideals’ in central Canada. 2017, 42(3):256-276.

[8] Lei Zhao, Chao Gui. City Waterfront Landscape Post Assessment Based on System Dynamics. 2014, 3326:5323-5326.

[9] Joanna Badach, Elżbieta Raszeja. Developing a Framework for the Implementation of Landscape and Greenspace Indicators in Sustainable Urban Planning. Waterfront Landscape Management: Case Studies in Gdańsk, Poznań and Bristol. 2019, 11(8)

[10] Donatella Cialdea. Landscape Features of Costal Waterfronts: Historical Aspects and Planning Issues. 2020, 12(6)

[11] Stephen Nepa. A History of Brooklyn Bridge Park: How a Community Reclaimed and Transformed New York City's Waterfront eds. by Nancy Webster and David Shirley, and: Central Park Trees and Landscapes: A Guide to New York City's Masterpiece eds. by Edward Sibley Barnard and Neil Calvanese (review). 2018, 99(1):121-126.

[12] Andrea Rossi, Yanet Vila, Federico Lusiani, et al. Embedded smart sensor device in construction site machinery. 2019, 108:12-20.

[13] Yong Jin Park, Marko Skoric. Personalized Ad in Your Google Glass? Wearable Technology, Hands-Off Data Collection, and New Policy Imperative. 2017, 142(1):71-82.