POLITECNICO
MILANO 1863

School of Architecture Urban Planning Construction Engineering

Master of Science in Landscape Architecture-Land Landscape Heritage

Visual Environment Analysis and Visual Perception of Urban Streets

Taking Milan and Shanghai as examples

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ABSTRACT

With the rapid growth of urban population worldwide, cities are facing population pressure and land shortage. Residents living in a noisy and crowded urban environment every day began feeling more and more unhappy or uncomfortable. This thesis advocates paying more attention to people's experience and feelings in cities and optimizing the urban environment from the perspective of human beings. Streets in cities are important public spaces for people to experience the urban environment. The visual experience on the street is abundant and interesting, and a good visual environment on the street can improve the mood of urban residents. This article starts with the vision, the most important sense organ of human beings. combining the visual characteristics of human eyes and visual psychology to analyze the visual environment and visual experience of urban streets.

I combined my own exchange study experience, taking the streets of Shanghai and Milan, both high density cities as examples. Starting with urban texture, selected typical streets with different texture in two cities as examples. Through investigation and analysis, combined with objective street spatial data and subjective human visual perception, to analyze and compare visual environment and visual experience. Finally, the study gives an evaluation and possible suggestions.

KEYWORDS

Human vision, visual perception, visual environment, urban street

ABSTRACT

Con la rapida crescita della popolazione urbana in tutto il mondo, le città si trovano ad affrontare la pressione demografica e la carenza territoriale. Chi vive in un ambiente urbano rumoroso e affollato ogni giorno si sente sempre più infelice o a disagio. Questa tesi presta attenzione all'esperienza e ai sentimenti delle persone in città per ottimizzare l'ambiente urbano dal loro punto di vista. Le strade cittadine sono importanti spazi pubblici attraverso cui le persone vivono l'ambiente urbano. L'esperienza visiva in ambito stradale è abbondante e interessante e un buon ambiente visivo sulla strada può migliorare l'umore dei residenti. Questa tesi inizia definendo cos'è la vista, l'organo sensoriale più importante degli esseri umani per poi combinare le caratteristiche visive degli occhi umani e la psicologia visiva per analizzare l'ambiente visivo e l'esperienza visiva nelle strade urbane.

Grazie alla mia esperienza di scambio studentesco, ho preso ad esempio le strade di Shanghai e Milano, entrambe città ad alta densità. A partire dalla trama urbana, ho selezionato strade tipiche e con trama diversa nelle due città. Attraverso indagini e analisi, ho combinato i dati spaziali oggettivi delle strade con la percezione visiva umana soggettiva, per confrontare l'ambiente visivo e l'esperienza visiva. Infine, ne ha dato una valutazione e possibili suggerimenti progettuali.

PAROLE CHIAVE

Visione umana, percezione visiva, ambiente visivo, strada urbana

CONTENT

■ BACKGROUND

● Visual Environment Condition in Chinese Cities

As Castells Manuel has observed, we humanity are in fact “in the midst of the largest waves of urbanization in human history” (Castells 2010). Two centuries ago, only 3% of the world’s population lived in cities (Sjoberg 1965). But, at the beginning of the twentieth-century, this number had increased to 14% (Mumford 1961) . So far, it’s already past 50% population live in cities (Zhao, Guo et al. 2017). According to United Nations estimates, by 2050, 68% of humanity will be "citizen" (United Nations, 2017). China as a rapidly developing country, has more and more urbanization cities, such as Beijing, Shanghai, Guangzhou and others, they are all highly developed and full of resources.

Meanwhile, with the process of rapid urbanization, high-speed urbanization cities are facing enormous population pressure and land shortage. Buildings in cities show architectural aggregation and high-rise growing, urban space was compressed into numerous narrow linear spaces, urban landscape been destroyed. Many urban residents begin to feel unhappy or uncomfortable and attribute their dissatisfaction to "urban disease" with its symptoms becoming more and more prevalent throughout China. And their demand for urban landscape has already become a kind of luxury. Therefore, the government starts to transfer the key point in urban construction from urban sprawl and urbanization to the pursuit of people-centered, cityscape and environmental quality.

However, the early urban planning has already left behind some problems. It used to pay more attention to the function but neglected the residents’ visual feeling, it produced a lot of chaotic and poor visual quality public space. People in such space can hardly to visual positioning, can become nervous, anxiety, depressed… It can also cause mental illness such as mental restlessness during long-term urban life in this space. This kind of visual problems can be considered as an important origin of urban residents' sub-healthy and social pressures. Therefore, improving the cityscape and the citizen's environmental visual experience in the new stage of Chinese urban construction is particularly important.

As the main transportation, the streets carry the most leisure and social activities in people’s daily life. It is the most important public space to experience the image of the city. If the visual environment on street is varied and interesting, undoubtedly, it can improve the mood of urban residents. Conversely, streets with disorderly, oversize scales could make the city lose vitality and walking on streets can become a negative experience for residents in their daily life.

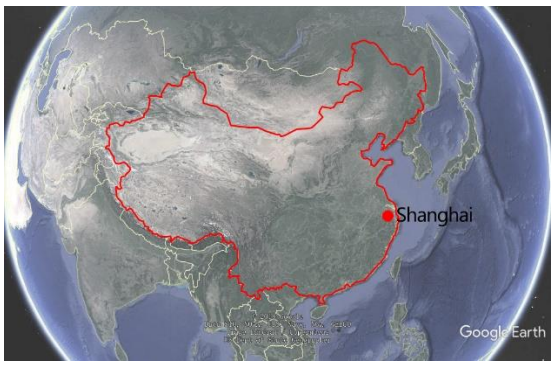
Shanghai as a fast-growing metropolis, has so many visual environments which urgent to be improved. How to build excellent visual landscape efficiently base on limited public urban space needs considering. And in order to design a better urban environment, it is important to understand visual quality of current environment and existing problems of urban public space. What I want to study is comparing the visual environment in High-density urban streets, combining the research of human visual characteristics to analyze the better organization and design way of visual environment elements. Integrating the landscape elements in urban streets and make use of the limited space in cities to improve the visual quality of urban public space most efficiently. Providing a more comfortable environment for urban residents to improve people's visual experience and emotions in city life.

In the choice of research case, combined with the author's own exchange experience in Shanghai and Milan, Italy, compared the visual experience and characteristics of the streets of Shanghai and Milan, which are both high-density cities. The study starts with urban texture, analyzed and summarized the characteristics of typical textures in two cities. Select the typical streets respectively in these two cities, by taking the difference in the texture of different cities as the starting point to analyze and contrast visual environment and visual experience. Finally, give the evaluate and possible suggestions.

- **Milano, Shanghai background analysis (lead out problem)**

General Introduction

Geographical location *Figure 1*



Shanghai

Milan

Source: Google earth, elaborated by the Author

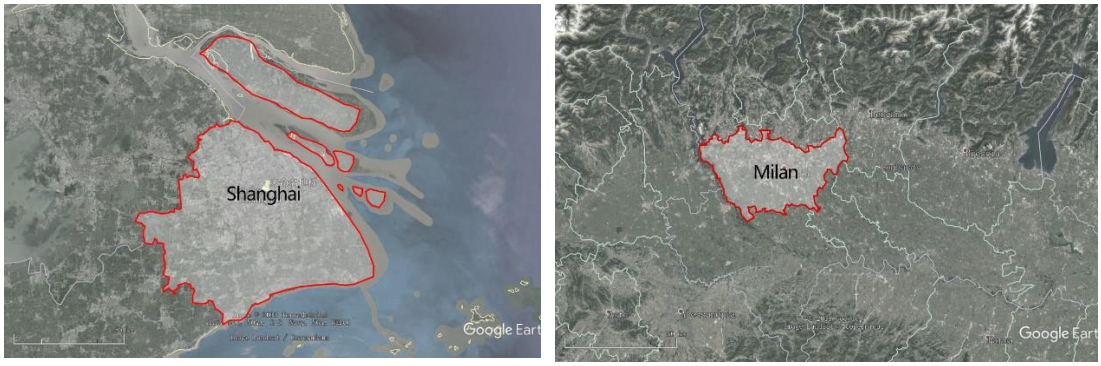
Shanghai

Located in East China, it is one of the municipalities directly under the Central Government of China (The State Council of The P.R. China Administrative Division). Located on the west coast of the Pacific Ocean, the east coast of the Asian continent and the front of the Yangtze River Delta (***Figure 1***), with an average altitude of 4 meters. It has a subtropical monsoon climate which is mild and humid, with four distinct seasons, full sunshine and abundant rainfall (www.shanghai.gov.cn).

Milan

Milan located on the Lombard Plain in central Europe, northern Italy (***Figure 1***). It is an important city in Italy and the capital of the Lombardy region. At an altitude of 122 meters, it belongs to the humid subtropical climate, with hot and dry summers and mild and rainy winters (www.weather-and- climate.com).

Administrative Area *Figure 2*



Shanghai **Milan** (province)

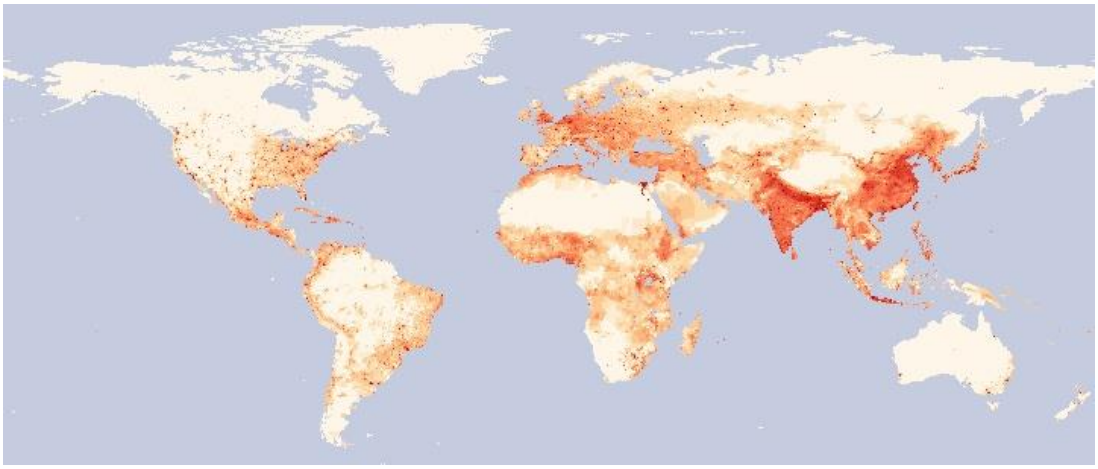
Source:

http://www.shanghai.gov.cn/newshanghai/xxgkfj/2035003.pdf

http://www.cittametropolitana.mi.it/portale/territorio

Elaborated by the Author

Shanghai currently has a city area of 6,340.5 km2 **(*Figure 2*, the scale is 50km). In terms of population, Shanghai had only 12 million inhabitants in 1982, but by the end of 2018, its permanent population had exceeded 24 million (shanghai.gov.cn). Constant land expansion and population growth make it one of the largest metropolitan areas in the world (Nations 2016). Only make a simple calculation we can get the population density in Shanghai is about 3,800/km^2. As the (***Population Density on Earth***) shows, globally, Shanghai can count a high-density population area.



Population Density on Earth *Figure 3*

Source: NASA EARTH OBSERVATION (NEO)

The city of Milan has a surface of 181 km^2 and a resident population of 1.35 million (density of 7,533 residents/km^2). The Metropolitan City of Milan constitutes an intermediate administrative tier, including 134 Municipalities, having a surface of 1,575 km^2 (***Figure 2***, the scale is 50km) and a resident population of 3.21 million (density of 2,038/km^2) (Del Fabbro 2018), making it the second-most populated metropolitan city of Italy after Rome.

From these data we can say both Milan and Shanghai bear a large number and high density of population which for the urban environment built is an undoubted challenge.

Urban sprawl

Shanghai

China's urbanization process and the speed of urban expansion are obvious to all. With the development of the Chinese city, the urban population has also grown dramatically. In 1960, there were about 110 million Chinese, or 16% of China's total population, living in cities. By 2018, the number of people living in cities has expanded to 830 million which is about 60% of China's whole population. For comparison, the entire population of the United States was about 327 million people in 2018 (United States Census Bureau).

China's urbanization began in the 1980s when the Chinese government starts to open the country for foreign trade and investment. With the development of Market Economy, villages morphed into booming cities and cities grew into sprawling megalopolises. Shanghai is the miniature of this development trend that has a tremendous change in the past 30 years.

This amazing shot is recreating and comparing the same framing and perspective as a photograph was taken in 1987, showing what a difference 26 years can make. The setting is Shanghai's financial district of Pudong (***Shanghai City Past and Present Comparison Figure 4***).

Shanghai City Past and Present Comparison *Figure 4*

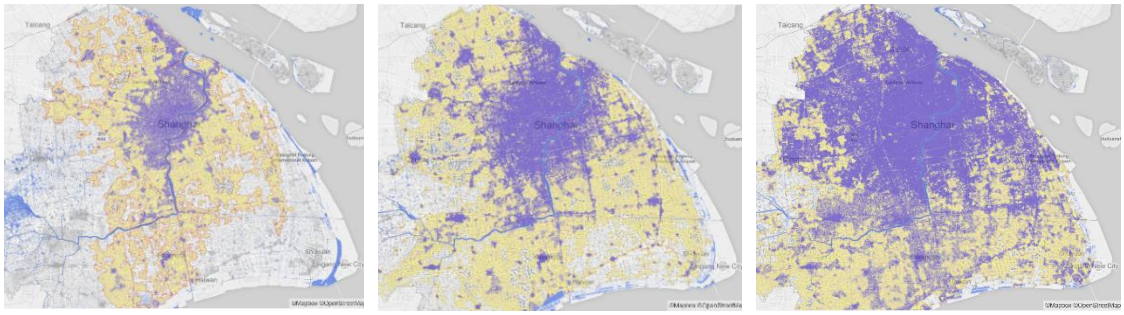
1987 **2013**

Source: https://www.theatlantic.com/photo/2013/08/26-years-of-growth-shanghai-then-and-now/

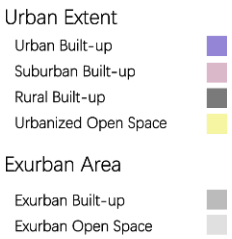
To describe Shanghai's urban development and expansion in the past three decades in one word, that is unprecedented. From the satellite image we can clearly see that the urbanization area of Shanghai has expanded significantly. From 308km^2 in 1984 to 6,340km^2 today, it has expanded 20 times in 30 years (黄富厢/Huang Fuxiang 1999). The historical images show clearly the core of the city is concentrated on the west bank of the Huangpu River. But then the city has expanded and its core is blurred now (***Figure 5***).

Shanghai urban sprawl trend *Figure 5*

1991 2000 2015



Source: http://www.atlasofurbanexpansion.org/cities/view/Shanghai_Shanghai



Milan

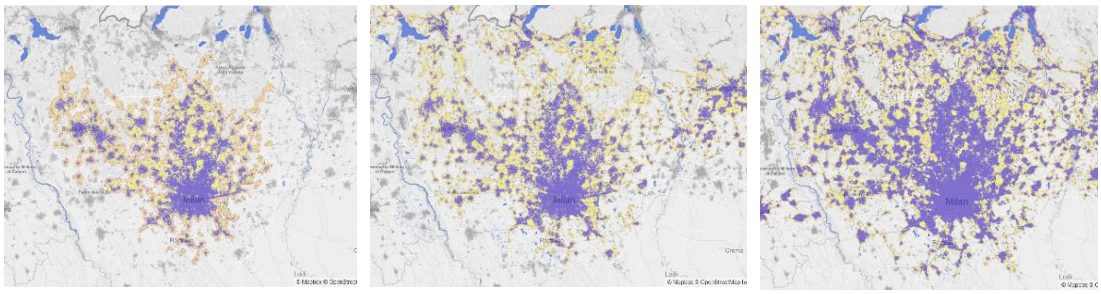
In the past thirty years, Milan has undergone dramatic physical changes that have dissolved the traditional city into a much wider territory (González 2009). The Urban Extent of Milan in 2013 was 277,177 hectares, increasing at an average annual rate of 4.4% since 2003 (***Milan urban sprawl trend Figure 6***).

Several first- and second-ring Municipalities constitute the outskirts of the metropolis nowadays. Within a 30 to 50km radius from Milan, other towns constitute the sub-centers of a polycentric metropolitan system and the nodes of a regional urban network, respectively (Del Fabbro 2018).

Part of the reason for this huge change in urban form is the rapid development of the urban economy, where manufacturing spreads in the suburbs of the city. And the public transport (especially the subway) also expands the city. The reason was also concerned partly by population growth, because of the economic development, the city attracting more foreigners, and people started moving out towards the outer periphery and surrounding towns (González 2009). In John M. Foot. Martinotti's study of urban development in Milan, he mentioned that these four categories of people changed the urban form of Milan in the 1980s and 1990s, namely: Residents by law, foreign workers, foreign consumers (tourists, students) and business commuters (Foot 1999).

Milan urban sprawl trend *Figure 6*

1988	2003	2013



Source: http://www.atlasofurbanexpansion.org/cities/view/Milan

Some experts have compared the growth of European cities and Chinese cities in the past decades, pointing out that Europe's compact cities were more likely to continue the process of compact growth. However, cities in China tended to grow in a sprawl pattern in the relatively rapid expansion process (Dong, Jiao et al. 2019). Comparing the city sprawl of Milan and Shanghai, just reflecting this trend. Shanghai shows characterized by its expansion to the surrounding area and the rapid growth of its urban area. Milan, on the other hand, has nurtured subcenters and Metropolitan network in the suburbs, with controlled growth in urban area.

Administrative division

Up to 2018, Shanghai has 16 municipal districts (shown in ***Figure 7***). These regions experience different development stages and characteristics because of their location, history, and established time.

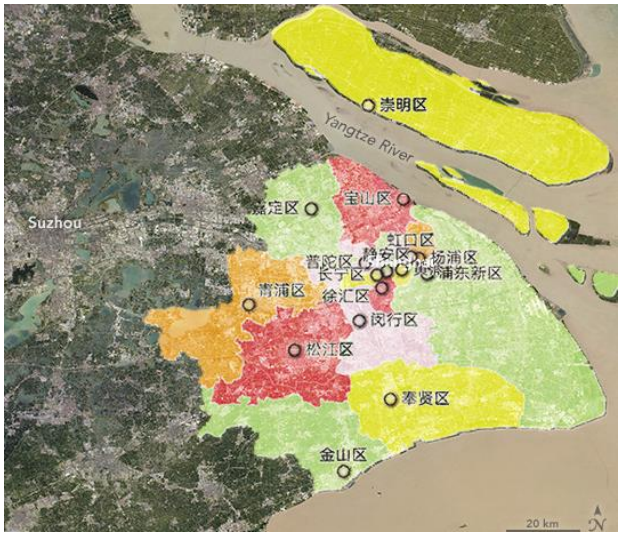
For example, Huangpu district located in the center of Shanghai, is a center of administration, commerce and entertainment. It’s also the oldest district zone in Shanghai, the most famous representative is “the Bund” which located along the Huangpu river. Its history can be traced back to 1844. It is a representative block of Shanghai's modern history and has many historic buildings.

Xuhui District located in the southwestern part of Shanghai's central city and is the sub-center of Shanghai. The various high-class garden houses in the former French Concession are one of the most distinctive examples. It's the senior residential area in Shanghai.

Yangpu District located in the northeast of Shanghai's central city. There are many colleges and universities and the technology companies relying on those college. This district has the largest number of emerging technology companies in the city.

The Pudong new district is a new administration area which has been established since 1990. The most famous is the “Lujiazui” area which located on the Bank of Huangpu River, facing the Bund across the river. It’s a national financial center with a magnificent commercial complex. There are many record-breaking super high-rise commercial office buildings, where being able to work is a symbol of corporate strength and status.

Shanghai administrative division map *Figure 7*



16 Districts：

Huangpu, Xuhui, Changning, Jingan, Putuo, Hongkou, Yangpu, Baoshan, Minhang, Jiading, Songjiang, Qingpu, Fengxian, Jinshan, Chongming, Pudong

Source:

https://earthobservatory.nasa.gov/world-of-change/shanghai.php

https://baike.baidu.com/item/

Elaborated by Author

The current administrative division of Milan comprises nine zone which is called “Municipio” in Italian. The policy was approved by the City Council on April 14, 2016 of the deliberative provision concerning the new Municipality Regulations. The first administrative district is the historical area located in the center, while the other eight districts are radially distributed (***Figure 8***).

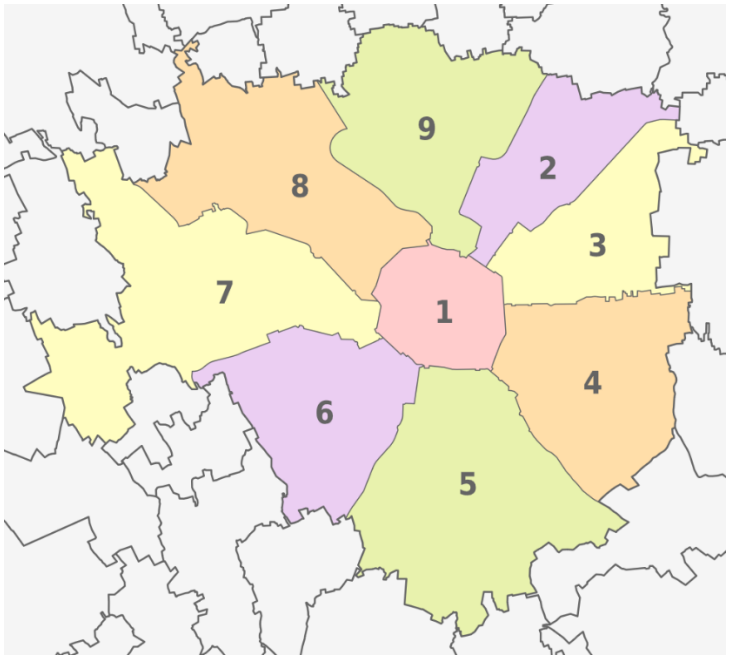
For zone 1, the city historical center, It is the least populated of the city's zones and one of the smallest zone, a significant structure is the church Duomo which is one of the most famous church in Europe. For the buildings in this area, the Milan government has strict protection systems and decrees, they are not allowed to be demolished. If the buildings can’t meet the current requirements, it will be re-used through renovation (Feilden 2007). It shows that the city of Milan and the Italian state attach great importance to the protection of history and culture (商开洋/ Shang Kaiyang 2017).

The other districts like zone 2, have an important transportation hub-Milan central station. It also connects Milan with various manufacturing plants in its metropolitan

area (from Sesto San Giovanni to Monza-Brianza), and the brown land issues started to be considered (e.g. the Pirelli area) (www.urbandivercities. eu/milan/).

Zone 9 in the north of the city is a new administrative area running mostly local service. The distinctive area of this zone is Bicocca which is an important industrial area in the first half of the 20th century. However, the deindustrialization began in the 1970s, it started “Progetto Bicocca” (Bicocca Project) which is the largest urban transformation project in the history of Italy. The companies like Pirelli, Siemens, Deutsche Bank, Johnson, Dell, Philips, etc. set their Milanese headquarters in Bicocca now. Another district Bovisa, an industrial area in the outskirt of the city since the second half of the nineteenth century, is a mainly residential suburb include Bovisa campus of Politecnico di Milano now. By undergoing a transformation, it dismantled or moved most factories out of city center (www.revolvy.com).

Milan administrative division map *Figure 8*



1. Centro storico
2. Stazione Centrale, Gorla, Turro, Greco, Crescenzago
3. Città Studi, Lambrate, Porta Venezia
4. Porta Vittoria, Forlanini
5. Vigentino, Chiaravalle, Gratosoglio
6. Barona, Lorenteggio
7. Baggio, De Angeli, San Siro
8. Fiera, Gallaratese, Quarto Oggiaro
9. Porta Garibaldi, Niguarda

Source: web.comune.milano.it

■ THEORY RESEARCH

● Concept explanation

Landscape

The European Landscape Convention defined “Landscape” as an area perceived by people, whose character is the result of the action and interaction of natural and/or human factors (Europe). The Convention clearly emphasizes the perceived relationship between the observer and the landscape, among the experience of all senses, visual is dominant, covering 87% of sensory perception（唐真 and 刘滨谊/ Tang Zhen and Liu Binyi 2015). Vision is the most important component of human perception at present (Bruce, Green et al. 2003). So that to study the landscape, visual is the most important part.

Visual landscape

The visual landscape has a far-reaching impact on us. In ancient times, our ancestors’ excellent vision, dexterous fingers and strategic thinking played an important role in finding food and shelter in the landscape and avoiding natural enemies. Vision is vital to human evolution and reproduction, people perceive the landscape scenery through a vision to obtain outside environment information, and this use to evolutionary feature continued in today although we don’t rely on it to survive anymore (帕特里克·米勒, 刘滨谊/ Patrick A. Miller, Liu Binyi 2013).

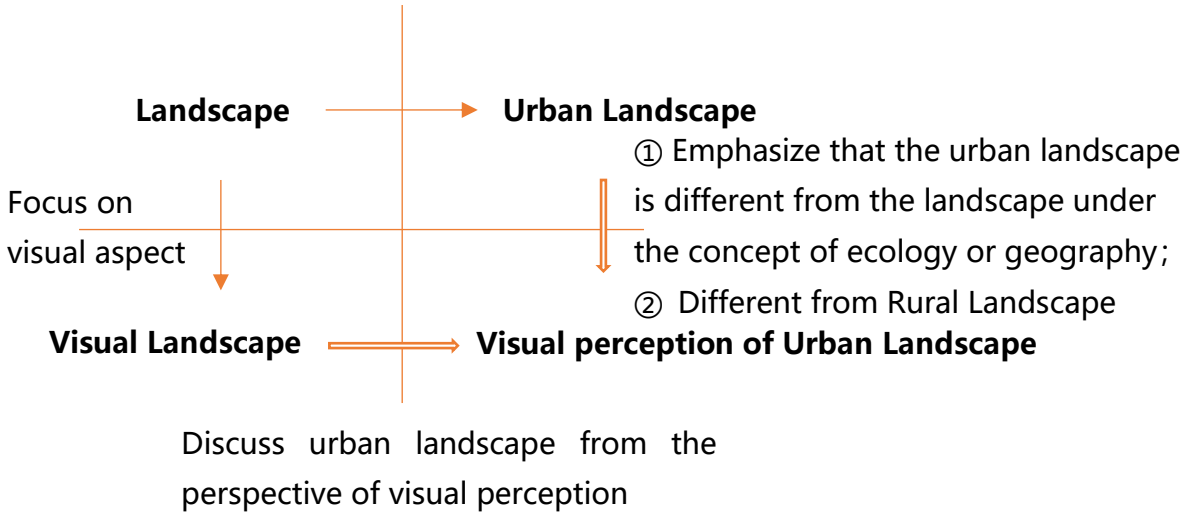
Visual landscape is mainly based on the perception and requirements of human visual image, according to the law of aesthetics, using space entity scenery to study how to create a pleasant landscape image. The meaning of visual landscape is to emphasize the dominant position of vision in landscape experience. In this respect, it is necessary to study the theory of landscape aesthetics. At the same time, the study focuses on the landscape environment form based on vision, which causes the psychological response of people. It involves to visual perception of landscape as the basic theoretical research of landscape architecture is interdisciplinary research. It has a wide range of fields, including physiological, psychological and spiritual aspects (邵钰涵 and 刘滨谊/ Shao Yuhan and Liu Binyi 2016).

Urban landscape

From the point of view of the origin and development of cities, cities are the political, economic and cultural centers of a region and are always in the process of metabolism. Urban landscape refers to the visual form of urban physical environment which is obviously different from nature and countryside.

Urban landscape can be understood as a complex of natural and artificial landscape. It includes not only artificial structures but also people and a wide range of city life.

In a broad sense, urban landscape is a visual whole of a city or a certain space in a city, including the cultural characteristics, function, human visual perception and social activities of various elements of urban landscape. In a narrow sense, urban landscape refers to the aesthetic environment of the city that people can feel visually. Therefore, urban landscape emphasizes the psychological response brought by urban space.



For visual perception of urban landscape, it formed by objectives and subjective perception. It includes not only all kinds of physical objects, which are composed of the urban physical environment and urban life, but also the subjective perception of people transforming this urban physical form into visual form (陈宇/ Chen Yu 2003).

To study visual landscape in urban space requires a clear definition of visual objective or subjective objects. From satellite images, we can “see” the aerial view of urban areas in tens of thousands or even hundreds of thousands of square kilometers. With various technological methods, human beings can see bigger, farther and smaller things. But in the field of urban landscape, the purpose of analysis is to improve the urban public living environment, and ordinary people mainly experience urban

landscape in their daily life. Therefore, the understanding of "visual" mainly refers to naked-eye natural vision, that is, the observation of the urban environment without the aid of visual tools or various technical means.

Visual preference and landscape perception

In China, we have a saying that" Everything has its beauty but may not be seen by everyone." It said by Kongzi, an ancient Chinese philosopher, educationist. Each one sees the beauty of the landscape differently, the beauty varies from person to person, so it can be hard to assess the beauty of the landscape in practice. Still, there have some similarities and commonalities, we can study from visual perception.

There are two types of responses to landscape perception, one is innate, one is acquired. The innate exist in our genes, is inborn, like we have a strong negative response to spiders and snakes, meanwhile, many scholars hold the view that humans have a natural positive response to water and green nature. The another acquired response to landscape is based on what we learned, for instance, people often don't like factories, crowded motorway, because we learned that makes pollution and do harm to us (帕特里克·米勒, 刘滨谊/ Patrick A. Miller, Liu Binyi 2013).

The innate preferences and perceptions to landscape for human beings mostly can be same and in common, we can study what landscape forms can bring positive perception to people, which can guide landscape design, improve and optimize the urban landscape environment. But for acquired response, it influenced by different cultures, religious beliefs, age, educational status... These all show a great impact on the otherness of landscape preferences, so that region to region, people to people can have a distinct landscape preference.

Visual landscape focuses on the visual characteristics of the landscape environment, mainly study the relationship between viewers and various landscape elements that exist objectively. In landscape space, different spatial scales and distances, different colors, line, plants, sunlight can attract viewers in different degrees. We can analyze which landscape elements and how to organize them can bring people better positive landscape feelings.

Visual Landscape Quality Assessment

There already have many research results about visual analysis of landscape space. From the Mid-1960s to early 1970s, developed country like American, English, Germany, etc. comes up with a series of bills to protect landscape environment sources. And many of the files required visual impact evaluation in landscape projects. Like "Guidelines for landscape and visual impact assessment" formulated by the landscape Institute with the Institute of Environmental Management & Assessment. It … For another instance, The Environment Impact Assessment (EIA) as an environmental management tool widely used on an international basis since 1970, which consider landscape and visual assessments as essential components. EIA became a statutory part of the planning process within the European Union through Council Directive

The early stage of visual analysis and research were mostly related to rural natural scenery and woodland industry, less of urban landscape space study. In recent years, technology development emerged, there are many new technologies like computer technology, digital image processing, computer graphics, artificial intelligence and other subjects. They are widely used in large-scale landscape planning and natural ecological fields. Still is the reference for analysis of urban landscape space.

● Challenge of research

The difficulties and problems of landscape and visual analysis and assessment mainly include the following aspects:

1. The visual quality does not have a uniform definition and standards. Professionals and the public may have different perceptions.

2. From the perspective of landscape aesthetics, there are many definitions of "beauty", and different people have different aesthetic pleasure from different perspectives, so it has a great subjectivity.

3. The theoretical research is in the preliminary stage, may not have too many guidelines to follow.

4. The visual experience let people feel the spatial distance, volume, space interface and direction characteristics of the urban landscape. Hard judge from an individual's subjectivity to the group's rational judgment.

■ HUMAN VISUAL-RELATED

Of all human senses, vision is the most developed. The structure of the human eye and their position in front of the head give human vision a very important ability. The human eye can detect and distinguish subtle details; can distinguish a wide range of colors; can determine the depth of the visual field by overlapping the sight. These abilities are universal biological characteristics endowed by human evolution.

For the entity in the urban landscape, visual experience can confirm the object and grasp most of its physical properties, such as volume, weight, surface color, pattern, hardness and texture; For the urban landscape space, visual experience can grasp the characteristics of distance, volume, spatial interface and direction; For various activities of urban landscape space, visual experience can understand the main body, content, form and process of activities（魏晓慧/ Wei Xiaohui 2008).

The formation of visual tendency is closely related to the development of our social life. With the development of social economy, people's life rhythm become faster and faster, people need more and faster access to information. The commodity society has accelerated the penetration of various forms of advertising into people’s daily lives, the success of advertising with visual expression as the main method promotes the visualization of information. At the same time, the development of digital technology also provides technical support for the visualization of information.

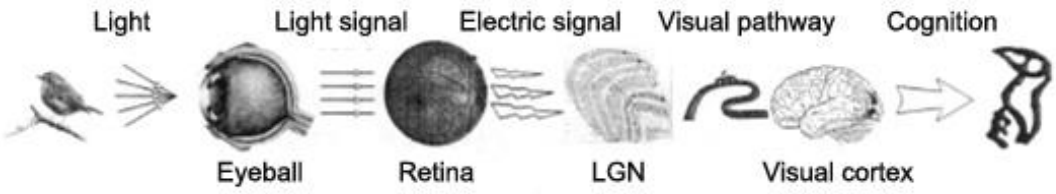
The research on the characteristics of Human Visual System (HVS) is mainly carried out in two aspects: visual physiology and visual psychology. Visual physiology analyses how the biological system achieves visual perception; visual psychology studies the relationship between visual perception and human psychology.

● Visual Physiology

Visual perception of the objective world depends on two major components of the human visual system: The first part is optical imaging system, eyes; The second part is the visual nervous system, including the retina, lateral geniculate body and visual cortex.

When the human eye receives the light signal, the scene is projected onto the retina to form a light image. The retina is the nerve perception layer of the eye, which

completes photoelectric conversion and primary information processing. Its function is to convert light images into visual electrical signals, and then transmit them through the optic chiasm and lateral geniculate body to the visual cortex which responsible for processing electrical signals. Finally, the cortex completes the recognition, perception and understanding of the object, and performs active adjustment of the eye according to the result, such as moving the gaze point, etc. Through a series of processes of visual information processing, we achieved the human visual perception and recognition of image and environment, as shown in ***Figure 9.***



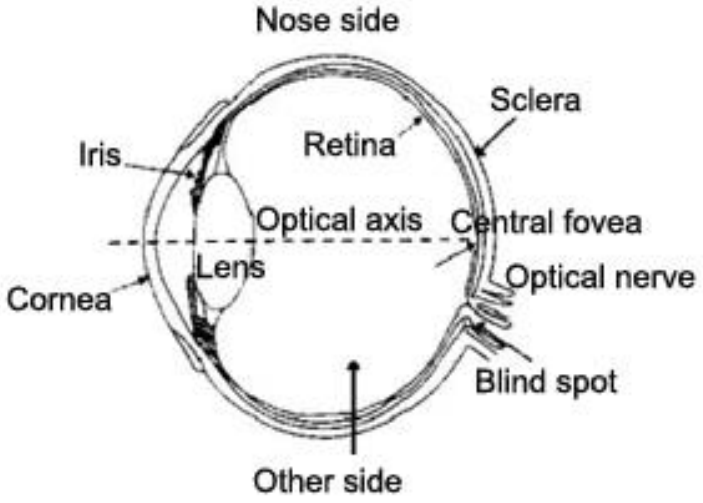
Visual Information Processing Diagram *Figure 9*

Source: Internet, Elaborated by Author

Human Eyes

The human eye physiological structure is shown in ***Figure*** *10*, mainly consists of cornea, iris, lens and retina. The cornea located in front of the eye and bulges forward, with a concentrating effect. The iris is the muscle that controls the size of the pupil of the eye, which is equivalent to the aperture of the camera, and regulates the luminous flux into the eye. The circular hole in the middle of the iris is called the pupil, which is responsible for adjusting the brightness of the light on the retina. The lens is equivalent to a zoom lens that adjusts the diopter under the control of the muscle to perform the focusing function. The retina located in the innermost layer of the eyewall, and its surface is distributed with large numbers of light-sensitive cells, which are divided into cone cells and rod cells. Cone cells are sensitive to bright light and have high resolution. They mainly distribute in the center of retina, the central fovea. Rod cells are sensitive to dim light and have low resolution, mainly distributed in the peripheral region of the retina. The retina is mainly responsible for photosensitive imaging, converting the light signals projected on it into bioelectrical signals that can be transmitted by nerves.

When observing an objective object, light passes through the cornea, iris, and lens, and is projected onto and around the central fovea of the retina which behind the eyeball. Then, the photoreceptor cells in the retina are stimulated by these light signals of different intensities to produce bioelectrical signals of different intensities. These electrical signals will be transmitted from the optic nerve to the visual center of the brain for further processing.

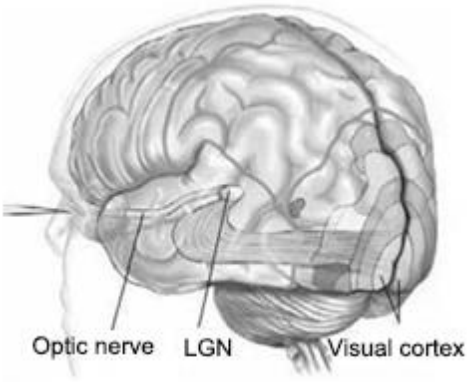


The structure of the human eye *Figure 10*

Source：Internet, elaborated by Author

Visual Nervous System

The visual central nervous system processes the visual signals transmitted by the retina, mainly management by LGN and visual cortex. Through visual neurons, the LGN is connected to the synapses of ganglion cells in most of the retina to receive electrical signals from the retina. At the same time, it also connected with the visual cortex to receives feedback signal. The visual cortex is mainly responsible for the advanced processing of visual information, such as extracting the structure, color, motion and other information of the image. Then, the processed information is passed to the outer cortex for further processing, such as pattern matching, recognition, understanding, memory, etc. of the image content. ***Figure** 11* to shown.



Visual Central Nervous System *Figure 11*

Source: Internet, elaborated by Author

The Visual characteristics of the human eye

1. Field of view

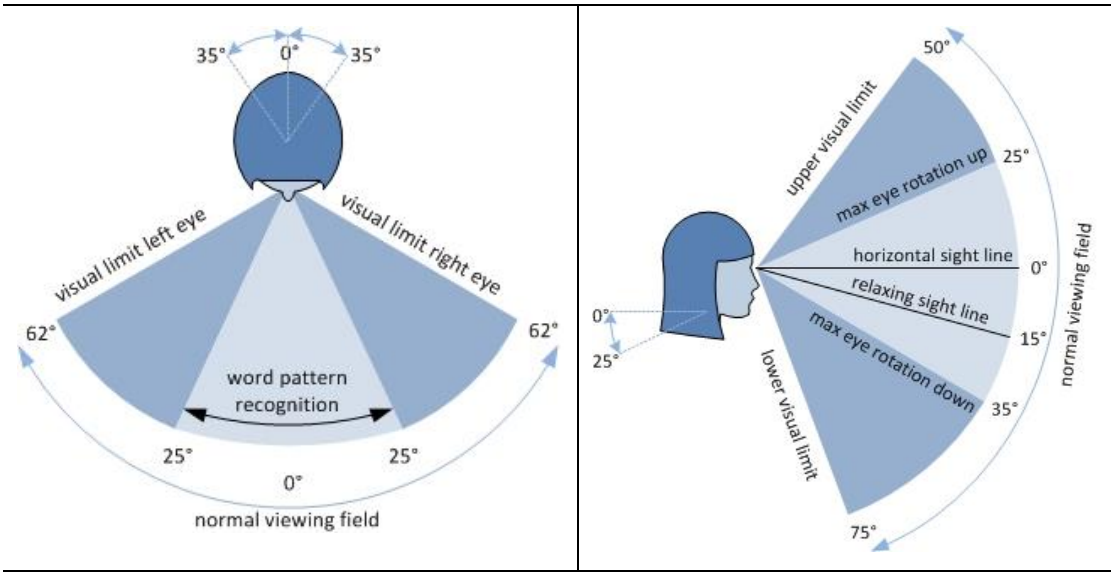
The way humans to move and the physiological structure of the human eye determine that our main range of sight line is in front of the body. The eyeball can be rotated when the head is fixed, and the line of sight is an irregular cone. The Field of vision means the spatial range that the human eye can perceive when the head and eyes are fixed. The normal person's visual field is shown in the ***Figure*** *12* (Van der Zanden 2016).

The horizontal line of sight of a single eye is about 164° (Tilley 2001)，there is a central region of 124° between the two eyes, and the views of the two eyes overlap in this range, together forming a visual region with a sense of depth. Within this range, there is a very narrow area called the spot area, which is the most accurate area. In addition to this, viewing area for text recognition that varies from 25° to the left up to 25° to the right. Research of C. J. Snijders c. s. about neck stress shows that rotation up to 35° is easy and does not cost any physical exertion, however, angles over 35° cause severe neck stress (Snijders, Van Dijke et al. 1991).

The vertical vision of the overall binocular range is approximately 120°, take the sight horizon as the standard, 50° upward and 70°downward. Human eyes can rotate

about 25° upwards and 35° downwards without moving the neck joint. Generally, the line of sight located at the position of 10° downward, and the range from horizon to 35° downward is a more comfortable region for sight. Therefore, in our visual picture, the horizon is generally located 2/3 above the picture.

Horizontal and Vertical Viewing Filed of the Eye *Figure 12*



Information taken from: "The Measure of Man and Woman: Human Factors in Design" (Tilley 2001)

Images from: "Readability in classrooms" (Van der Zanden 2016)

• Visual Psychology

Visual perception

Visual perception consists of three parts: visual physiology, life experience and accumulation of visual experience. People have accumulated a lot of visual experience, life experience and cognitive knowledge about forms in their daily life. This long-term accumulation in life will form a sensory reference, and this frame of reference will affect, repair, and testify people's feelings (Gregory 1973). We human being use language and other symbols to refer to our experience. The relationships between these symbols and their corresponding physical and physiological variables are both in the domain of visual reception (Cornsweet 2012). For example, the triangle gives people a

sense of stability, and the feeling of this intention will be expressed as a perceptual intuition rather than a rational judgment. This is a kind of visual psychological reaction that integrates visual physiology and life experience. Once this kind of psychological reaction forms a thinking orientation, it will play a role of adjustment and correction in the process of watching.

Visual illusion

According to the Merriam-Webster Online Collegiate Dictionary, an illusion is 1. something that deceives or misleads intellectually; 2. perception of something objectively existing in such a way as to cause misinterpretation of its actual nature.

Visual illusions occur due to properties of the visual areas of the brain as they receive and process information. In other words, your perception of an illusion has more to do with how your brain works -- and less to do with the optics of your eye.

An illusion is “a mismatch between the immediate visual impression and the actual properties of the object,” said Michael Bach, a vision scientist and professor of neuro biophysics at the University of Freiburg Eye Hospital in Freiburg, Germany. Bach also said, “Everything that enters the senses needs to be interpreted through the brain -- and these interpretations occasionally go wrong” (abc NEWS).

In space, due to the interaction between visual objects, the forms or colors may be mutated. There are both subjective and objective reasons for causing visual illusions. Subjectively, due to the involvement of visual function in past life experiences and cognition, the effects of habits or stereotypes will modify or correct the eye; The objective aspect is mainly due to the mutative effect of the form of the object and the color factor in the interaction relationship.

For landscape design, when placing objects in a place, we should not only consider the size of the object. Based on the principle of visual illusion, it is necessary to consider the surrounding environment and whether it brings uncomfortable visual experience.

Visual attention

The human brain has limited ability to process a variety of complex information, in the evolution of the human visual system (HVS), gradually, created a mechanism to filter the information. When people face complex scenes and landscapes, the human visual system can quickly focus on a few significant visual objects (刘滨谊 and 范榕/

Liu Binyi and Fan Rong 2013). Claus. Bundesen describe this process as visual attention (Bundesen 1990).

Visual attention mechanism

The variety of visual information exposed to human daily life environment strongly exceeds the upper limit amount of information that the human brain can effectively handle. Visual attention mechanism can screen and filter the information to keep the crucial part. There are two basic mechanisms, one is independent of task, named “bottom-up” or “stimulus-driven”; the other is dependent on task, named” top-down” or “goal-driven” (Itti 2000). The first mechanism is a physiological response of human eyeground to viewed Landscape, is driven by external stimuli. For example, bright objects such as red one in a landscape space can make people's heartbeat accelerate and promote human blood circulation, etc.; The second mechanism is a subjective awareness to search a target, such as people's yearning for scenic spots, parks, green spaces and famous scenic sites (刘滨谊 and 范榕/ Liu Binyi and Fan Rong 2013).

Visual Saliency

When human beings are in an unknown natural environment, visual begin observing and scanning the natural environment, our attention tends to focus on areas that are significantly different from the surrounding environment. This feature called “visual saliency” (Kadir and Brady 2001).

Visual perception and culture

We could "see" on the street are mothers and daughters, we could also “see” and understand the two people who hug in the station are the couple who are saying goodbye. Physical objects, types of people and their relationships are clearly and easily to understood through our observations. This very common and easy-to-practice skill is not born with but acquired through social acquisition (刘思宜/ Liu Siyi 2008). What we see is always constrained by the knowledge we have, such as the type of culture we learn, the common knowledge we have. What we understand is the product of a long-term socialization process, that’s a very important to understand the relationships between visual perception and cultural.

Visual preference form

1. Integration

Visual psychology tells us that when we look at objects, people are always actively looking for internal organizational relationships and summarize them as a whole object. Gestalt psychology believes that visual psychology has a tendency that It can make up for the discontinuous and gapped graphics as much as possible base on visual (Koffka 2013). This is the visual psychological tendency of visual integration, complementation, and closure (Toccafondi 2002). The shapes with similar features make up a whole form, and vision will naturally connect similar shapes as a whole form. In addition, a closer ratio of size makes it easier for elements to form an overall relationship, If the size changes dramatically, it will create a messy feeling.

2. Simplification

The human eye tends to see any stimulus pattern as the simplest shape that is known to be allowed. Arrange the messy parts into a kind of canonical form, change the irregular shape with a lot of details into the basic form of geometry, and Let all changes with sizes, colors and curvatures be arranged in a gradual sequence. These are often used orderly, standardized methods to achieve a simplified effect. Therefore, during design practice, we could deal with the formal relations in an orderly way, to conform the certain forms and laws in order to optimize the visual perception experience and make it easier for people to grasp the environment.

3. Order

In the ecology of man and nature, order is everywhere. Leaves opposite or alternate, petal arrangement and Symmetrical shape of butterflies, etc. all have arrangement structure and mathematical logic. The famous semiotic philosopher Ernst Cassirer said: “Science gives people order in thought, morality gives order in behavior, and art gives order in terms of feeling phenomena and understanding” (Cassirer 1953). Order is undoubtedly the important aspect on studying the visual form effect. According to the scientific analysis provided by visual psychologists, it can be confirmed that people

have innate instinct to adapt to order and perceive order, as well as the diversity of judgments and choices about the sense of order in life.

Experience has shown that people will seek different visual psychological compensation under different circumstances and conditions, so the need and choice of order will be different. For example, people living in cities for a long time will have visual fatigue in the structure of the building, and they are eager for the disordered state in the rural village; however, people who have lived in the rural village for a long time will have a strong sense of freshness and curiosity about the straight roads of the neat buildings in the city. From this we can see that people's adaptation to a certain order is not fixed. The adaptive design of order sense requires corresponding selection and treatment for specific situations and conditions.

Order makes people feel balanced and relaxed, but change can arouse people’s attention and makes them feeling rich and changeable visual effects. One extreme of the sense of order is neatness, consistency and monotony, while the other extreme is chaos and changeability. There is a moderate relationship between order and change, designers should constantly adjust these two poles in order to incorporate the richness of diverse changes into organized organization.

4. Balance

There is a balance concept about force in physical. If the various forces of an object can cancel each other out, the object is in an equilibrium state; The principle of balance in mechanics is also applicable to the sense of balance in visual psychology. Unbalanced and unstable objects in the environment can cause viewers' anxiety and negative emotions. For landscape design of the site this undesirable environmental impact should be avoided. The sense of balance originates from people's understanding of the laws of nature, this is exactly the physical phenomenon in life affects our visual psychology.

Visual characteristics of people in streets

1. Motion speed of viewpoint

The viewpoint movement speed is also an important parameter for describing the visual characteristics. The differentiation of the speed of viewpoints in modern cities

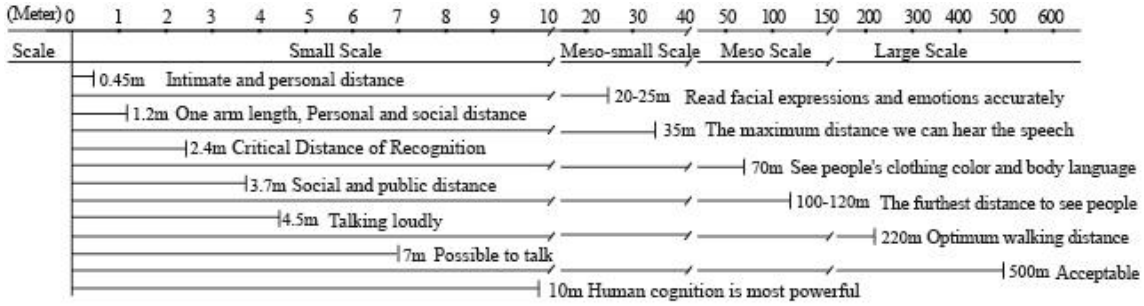
includes walking (5km/h), bicycles (8-15km/h), buses and trams (10-25km/h), cars and light rails (30-45km/h). Different modes of travel have different speeds.

For visual reception, it works better on walking. When we walk, the speed of 4-5 km/h gives us enough time to observe the faces and details of passers-by, capturing all the scenes and details. When we ride a bicycle (at a speed of 12 km/h) or run (at a speed of 18 km/h), it is still possible to observe quite a few details, still able to perceive and have a visual impression. But we should assume that the road is flat and the surrounding environment is easy to understand, the situation also need to be controllable and acceptable; If the road is full of obstacles, or the scene is too complicated, our running speed should be reduced because we couldn't have time to see, understand and react. A good example is the motor vehicle accident on the road, it proves that low speed gives us enough time to observe what is happening around us.

2. Scales-behavior-visual reception

Scales- behaviors psychology: The following ***Scales* - behavior psychology data comparison** *Figure 13* reveals the relationship between scale and human behavioral psychology. Different scales will bring different psychological feelings, which will lead to diverse human activities.

Scales - behavior psychology data comparison *Figure 13*



Data from: "The Hidden Dimension" (Hall 1910); "Cities for people" (Gehl 2013), Elaborated by Author

Arm length principle: The minimum non-contact distance, the individual seeks to maintain this narrow but vital distance, which makes the situation safe and comfortable.

Edward. Hall summarized four types of distance for social behavior in “The hidden dimension”, and each case shown in a specific photo in ***Psychological distance*** **of social behavior** *Figure 14*.

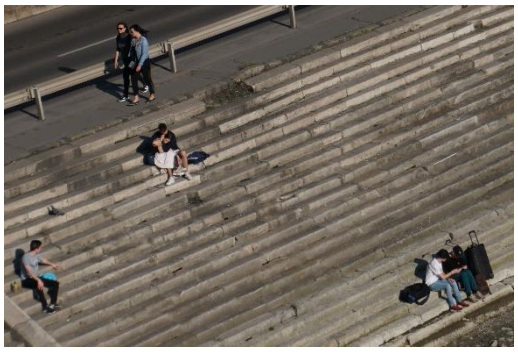
Intimate distance: 0-0.45m, for emotional communication;

Personal distance: 0.45-1.2m, for contact with close friends and family;

Social distance: 1.2-3.7m, for communicate daily information;

Public distance: more than 3.7m, for more formal or one-way communication.

Psychological distance of social behavior *Figure 14*

0-0.45m: Intimate distance	0.45-1.2m: Personal distance
	
1.2-3.7m: Social distance	> 3.7m: Formal communication distance
	

Data from: “The hidden dimension” (Hall 1910)

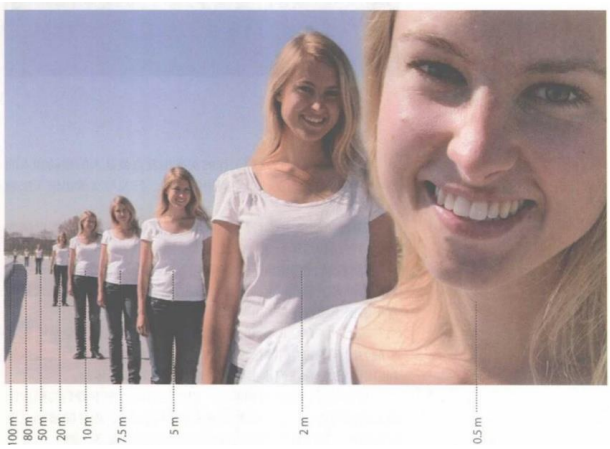
Photography from the Author

Nowadays, urban planning decisions are mostly carried out on the plate, Traditional knowledge about scales and proportions is gradually being discarded; While cars and modern transportation bring convenience and speed, they also confuse the scale and dimensions of the city. The organizational form of the city, the lifestyle and experience of urban residents have undergone tremendous changes. What we need to do is to consider the common scale principle of people's adaptation and apply it to the site design to meet people's comfortable communication and provide a pleasant environment.

Visual perception distance

Based on the background and light, we can identify people 300-500m away from humans rather than animals or bushes, only if the distance reduced to about 100m can we see movement and rough body language; When the distance is close to about 22-25m, we can accurately read facial expressions and main emotions. So, in general, the social boundaries of vision are 100m, within 100m we can see people in motion; 25m is another important boundary, starting to interpret emotions and facial expressions (shows in ***Distance and*** **visual perception** *Figure 15*). For landscape design, this is the physiological limit data we need to know about human beings (Gehl 2013).

Distance and visual perception *Figure 15*



Source: “Cites for people” (Gehl 2013).

The visual scale of 100m is also reflected in the size of most squares in ancient cities. Such a size range can be found in many ancient squares in Europe. Squares are rarely larger than 10,000 square meters, most of the measurement result is about 6,000-8,000 square meters. In China, however, the size of large squares is frequently more than tens of thousands square meters.

■ URBAN TEXTURE ANALYZE & TYPICAL STREET SELECTED

● Urban Texture analysis from the Perspective of History

Shanghai

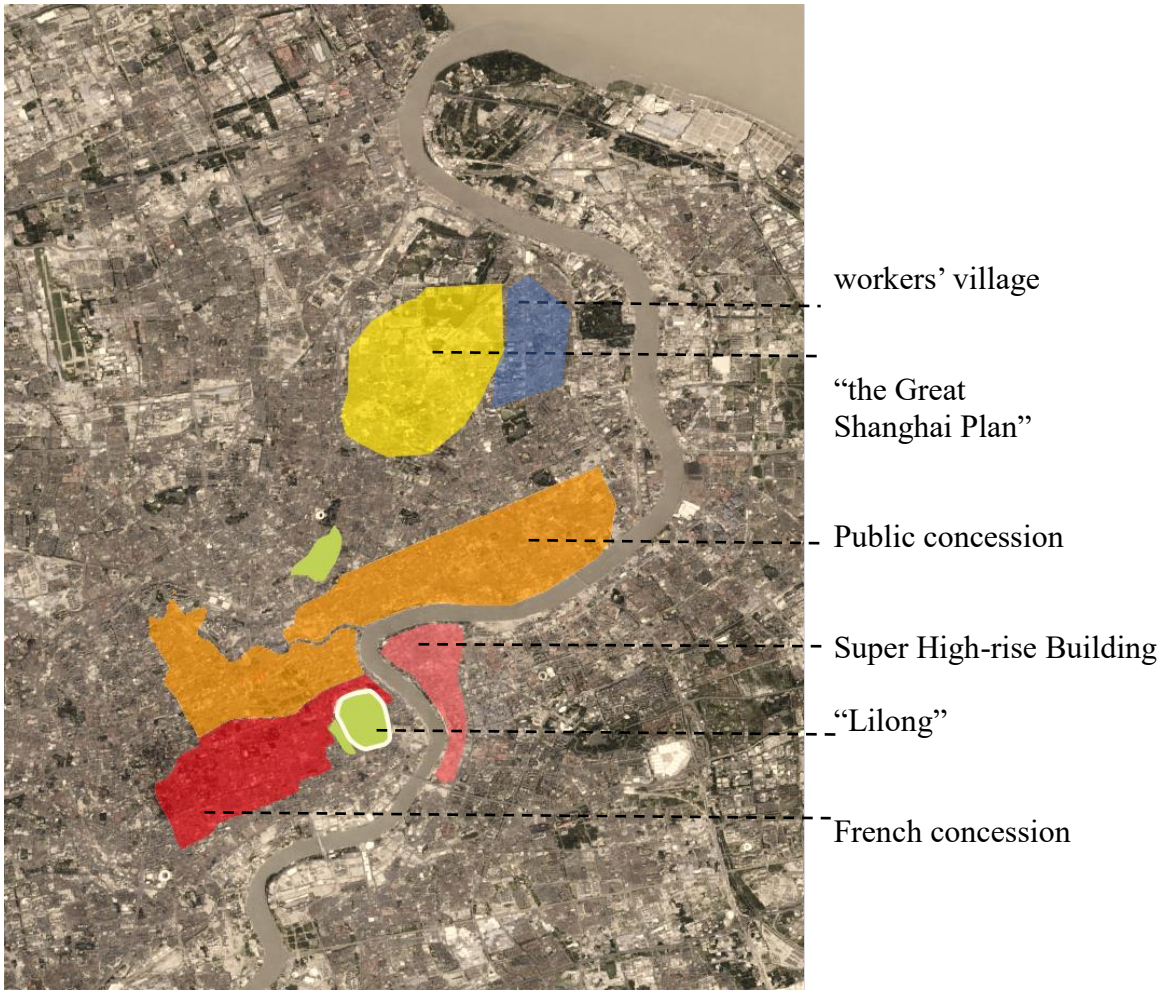
Shanghai used to be a fishing village with port, but now is the busiest and most important port and commercial city in China (王昱/ Wang Yu 2008). Shanghai's superior geographical location and economic potential made it the center of conflict in the 19th century, both Britain and France were trying to control the city. And the Japanese invaded Shanghai during World War II too. After experiencing the colonial history, the Japanese war of aggression and regime change, Shanghai entered the stage of modernization in the 21st century. And it has become the fastest growing city in China and one of the most economically developed cities which considered as the commercial and financial center of China.

Shanghai's urban construction has gone through five major stages along with the historical process: The first stage was from 1843 to 1927, by that time, leased territories belong to different countries began to appear one after another. The development of urban construction is manifested in the respective development within the concessions; The second stage, from 1927 to 1937, is a relatively stable period under the rule of the National Government. They put forward the urban planning of the “Great Shanghai Plan”; The third stage was from 1937 to 1945 when Japan invaded China, Shanghai urban planning was significantly influenced by Tokyo's planning; The fourth stage is the construction of the new “workers’ village” house built with the socialist movement after the founding of New China in 1949 (王昱/ Wang Yu 2008); The fifth stage is the emergence of a large number of modern high-rise buildings and commercial residential buildings since Shanghai entered the modernization stage (朱金, 王颖/ Zhu Jin, Wang Ying 2011).

The planning and construction of cities always constantly changing in the course of history. The changes of functions, techniques and rulers in the region may affect the urban form, thus producing different characteristics of urban textures. Different urban patterns in cities were constantly changing and merging, growing together in Shanghai, a city with a history of only 300 years (孙施文/ Sun Shiwen 1995). Through the analysis

of the main historical process in Shanghai, I summarized typical textures in different stages of the city and marked their distribution in city (***Distribution of* typical texture in Shanghai** *Figure 16*), and then gave a brief explanation to these five typical textures:

Distribution of typical texture in Shanghai *Figure 16*



Source: Google earth, http://news.ifeng.com

Elaborated by Author

（1） 里弄 "Lilong"

The first distinctive urban texture in Shanghai is "Lilong", it means lanes and alleys, it's the narrow lane between main streets. Along its sides distributed residential houses

and it leads to the interior of the residential area. It's kind of like Beijing's hutong, they're all traditional residential forms. After Shanghai opened its port, the leased territory poured into large numbers of people, to make full use of the land, the designer combines European townhouses with traditional quadrangle dwellings to create a new architectural from which combines Chinese and Western cultures (莫天伟 and 岑伟/ Mo Tianwei and Cen Wei 2001). The construction of “Lilong” in Shanghai lasted for a century, making the most representative traditional residential form in Shanghai (王昱/ Wang Yu 2008).

Looking down from high altitude, the roads intertwined vertically and horizontally are like arteries, dividing the city into several small districts. Within each district, there are many small passages between buildings which densely packed throughout the city, it just as small as capillaries, but full of vitality. It is these small passages that Shanghai residents call them "Lilong".

（2） Concessions

Concession in territory means leased territory, is an area within one country that is administered by another, usually conceded by a weaker country to a stronger one. For historical reasons, formed such important urban texture:

From 1840 to 1842, when the Qing government was defeated in the Opium War and was forced to sign the “Nanjing Treaty”, which made Shanghai the earliest trading port in China. British businessmen entered Shanghai and opened their leased territory (ability to rent or build a house for a long time within a certain area). After that, the U.S. and French concessions have been established in succession (黄亚平/ Huang Yaping 2003). The properties of the concession area determined that the area will be developed and transformed mainly by foreigners (according to their own style and needs). Therefore, during this period, Shanghai's urban construction and architectural style began to show the characteristics of European architecture.

The consulate built by the national government, the various foreign bank built by foreign businessmen and Churches built by foreign missionaries, all these structures built in concession at that time, now has become the landmark historical buildings in Shanghai (王昱/ Wang Yu 2008). The most typical is the Bund and Nanjing Road. Because of their convenient location, there are full of banks, insurance companies,

shipping companies, commercial buildings and other important commercial organizations. The building height is more than 8 floors, and the façade is luxuriously decorated with the Gothic architectural style.

（3） “The Great Shanghai Plan”

This especial urban form and texture has formed during the period of the Kuomintang (KMT) government were in power. The Shanghai Municipal Government put forward the first comprehensive and complete urban planning in modern Shanghai: “the Great Shanghai Plan”. This ambitious plan began with the construction of the city axis and major public facilities, in a few years, built an incredible New Town relative to another city center in the concession, but then it stopped because of World War II and finally gave up (朱金, 王颖/ Zhu Jin, Wang Ying 2011).

" The Great Shanghai Plan" of 1929 was basically based on the Western Baroque urban planning (黄亚平/ Huang Yaping 2003). It initially emphasized the pursuit and worship of power, so it showed a grand and beautiful form of urban space. For example, the central area of the Plan forms a cross-shaped square at the transportation hub and center; the square radiates many main roads around it, forming a certain cobweb-like road, reflecting the concentration of power and magnificence of space, forming the “baroque” urban landscape with a strong visual impact.

（4） Workers’ Village

This texture is the embodiment of a large-scale reproduction of an era's architecture. It’s a vast group of workers’ houses, it has become a symbol of the times because of its large scale, distinctive style and main service for the working class. From the establishment of the People's Republic of China in 1949 to the beginning of the market economic reforms in the 1980s, with the socialist movement at that time, social housing and workers' new villages were built on a large scale in China's land. The focus of urban construction has changed to the construction of the "workers’ village" to improve the living conditions of the working class (王昱/ Wang Yu 2008).

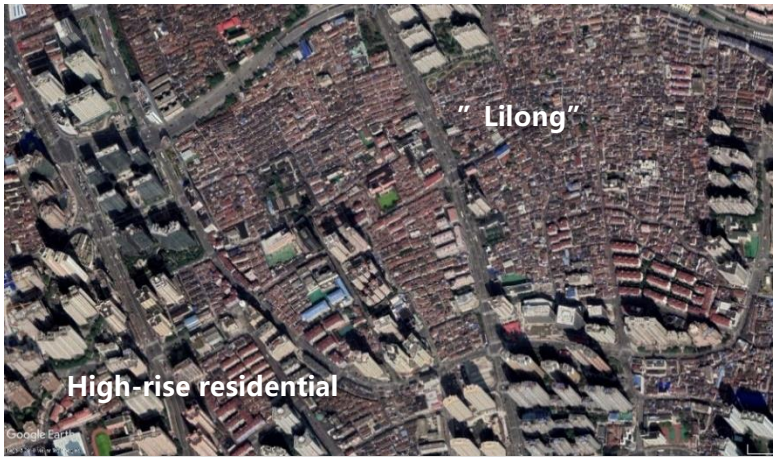
（5） Modern City Construction

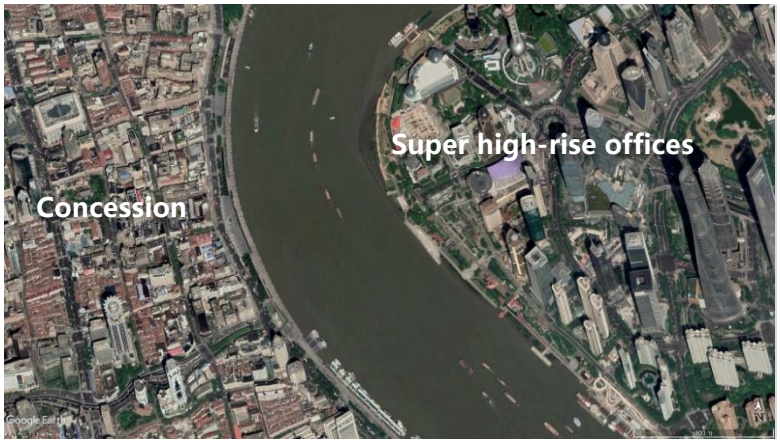
After Shanghai entered the modern city construction, the building began to grow vertically, and the urban texture shows a sudden change. Due to Shanghai's large

population base, housing shortage and low living standard, and the influx of large numbers of migrants after the reform and open up (赵柏洪/ Zhao Bohong 2007), solving the housing problem of the citizens has become a major focus of Shanghai urban construction.

In the specific historical period of China, the residences of workers and employees were allocated by the state. Since the commercialization of housing approved by the state, the concept of real estate and commercial housing emerged. Since then, the urban texture has been expanded, the community becomes a basic urban unit (王昱/ Wang YU 2008), and the residential buildings are related to streets in the form of groups. Like most cities across China, the community has become an important component of Shanghai's current urban construction.

Typical urban texture in Shanghai *Figure 17*





"Lilong"

High-rise residential

Buildings in the Concession

Super high-rise offices

Workers' village

Source:

Google earth

https://image.baidu.com

Milan

Milan is the most developed city in Italy and has a long history which is a good example of the city's coexistence of history and modernity. The history of this city can be traced back to 600 B.C. when the Gaul established the original city of Milan (Livius, Weissenborn et al. 1860). And then Romans fought and conquered the entirety of the region.

The Roman Empire collapsed in the 3th century, and Milan started of a tortuous period of barbarian invasions at the beginning of the 5th century. After a long war period, to against the control of the German emperors, the city-state born in the 11th century (www.turismo.milano.it). But It did not last a long time, however, the City States began fought each other to try to limit neighboring powers. A period of peace followed, during which Milan rebuilt the basilicas destroyed by the Germans and put up new churches and palaces.

From the Visconti to the Renaissance (13th to 15th centuries), the city-states period ended with the rule of the Visconti, in power from 1277 to 1447. The construction of Milan’s Duomo (Cathedral) and Castello (Castle) began in this period (1386). In 1450, Francesco Sforza, put down an attempt to restore the power of the city-states, marking the rise of the Sforza Dynasty. A period of rapid growth followed, Milan became the biggest and richest city in Italy, as well as a lively center of culture and the arts which makes Milan one of the leading cities of the Italian Renaissance (Welch 1995). The Sforza Castle and Ospedale Maggiore were completed in this period. It was also the period of Leonardo da Vinci, resident of Milan for almost twenty years, where he redesigned the Navigli and painted The Last Supper.

The year 1500 was a turning point: The city was contested by France and the Valois on one side and by the Hapsburgs of Austria and Spain on the other. Then the other noteworthy year was 1630, when the city was devastated by the plague (Cipolla 1981). In 1713 the rule of Milan passed from the Spanish to the Austrians.

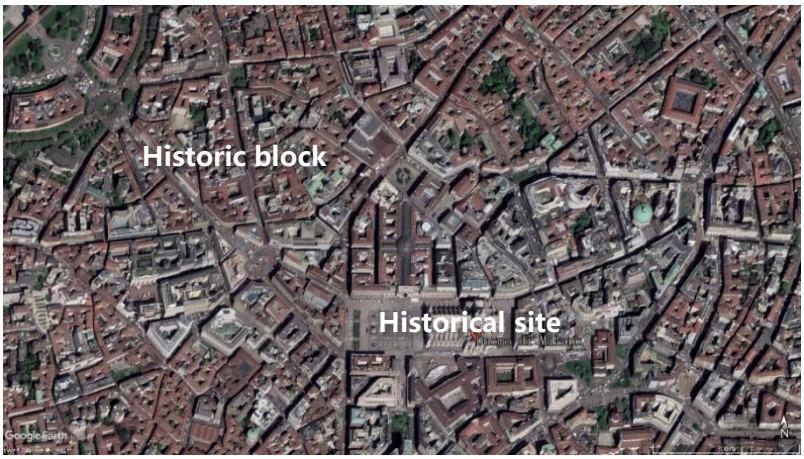
And in 1848, the Milanese rebelled against Austrian rule, ultimately unified and Established the Kingdom of Italy in 1861. The political unification of Italy cemented Milan's commercial dominance over northern Italy. Rapid industrialization and market expansion put Milan at the center of Italy's leading industrial region. As Milanese banks

dominated Italy's financial sphere, the city also became the country's leading financial center.

Later World War II had profound effects on Milan. The bombing of the Allied Forces caused more than a thousand of deaths and the breakdown or damage of thousands of buildings (around 30 percent of the city houses completely been destroyed and another 30 per cent had to be demolished immediately after the war) (Mingione, Mugnano et al. 2007), much of the center also been destroyed, La Scala, the Gallery and Palazzo Reale were ruined (Morgan and Morgan 2007). During the post-war economic boom, a large wave of internal migration moved to Milan caused rapidly grew of population (Ginsborg 2003). During this period, Milan was reconstructed in large scale, with the building of several innovative and modernist skyscrapers, such as the Torre Velasca and the Pirelli Tower (Berry 2002).

In the 1980s, with the success of the Milanese fashion industry in international, Milan became one of the world's fashion capitals. There also a marked rise in international tourism in the city. In the early 21st century, Milan underwent a series of sweeping redevelopments. Construct the New business districts such as Porta Nuova and CityLife (Saporito 2016).

Typical urban texture in Milan *Figure 18*



City life

Via Dante

Duomo

Source: www.milanoguida.com/ Googole earth/ it.wikipedia.org/ news.milanocard.it/duomo-of-milan.

Each period of historical crisis, advance, and consolidation has been reflected in the organic structure of Milan, and these ancient urban textures been well preserved. For a thousand years, the core of the city was located around the present cathedral, the Duomo. All the Castle, cathedral, and a newer commercial area center on the Piazza Cordusio continue to dominate the city center. What else are the entire industrial districts developed outside the city boundaries, particularly to the north and northeast which makes the city now combines with the satellite towns of its periphery, forming a typical metropolis.

In addition to the ancient textures left over from history, the city's growing new projects have produced different textures in the new era. For example, the new project Fiera of Rho-Pero as a new exhibition area in city; the City life project in the old location of Milan Fair which will host the international museum of design and it

contains a large public park; the area Garibaldi -Repubblica host the project “city of fashion” with a museum of fashion, a commercial area and part of the University.

These projects will re-shape the city image, but there still has the pressing issue of housing affordability, so that most of the residential area will be directed to a high-level house market which will create a new texture in city.

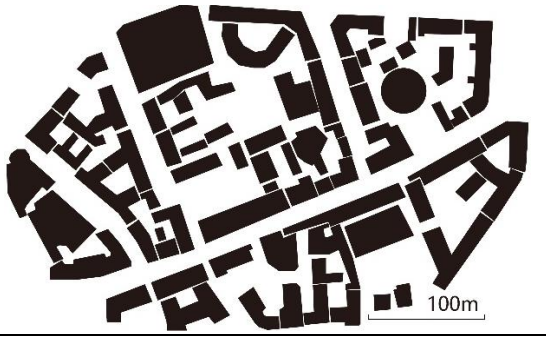
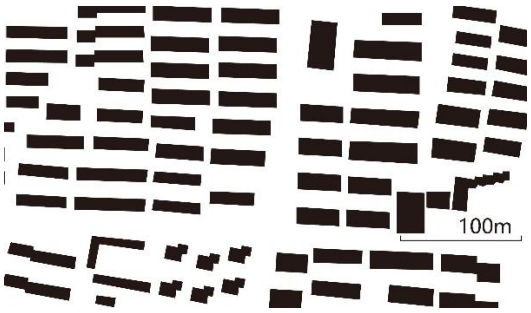
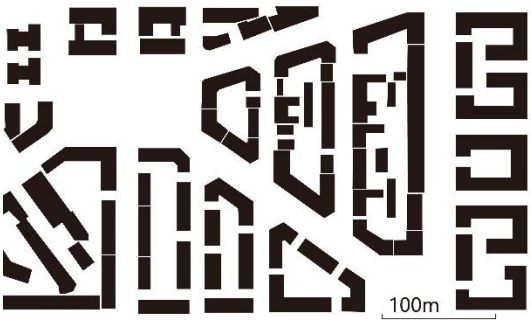
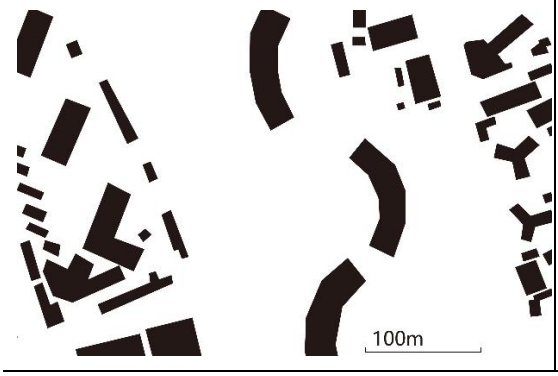
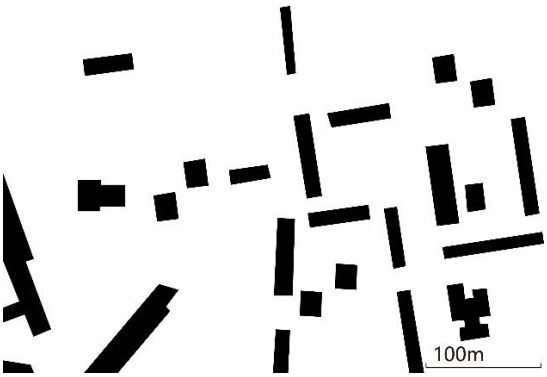
- **Typical Street Selection**

The identification and analysis of typical texture in these two cities inspired me the way to choose the specific street object in my visual research. From the top view, their visual texture is already so different, I can't help thinking, in the 3D visual space, what kind of different visual perception will they bring? Although I know that some studies on the visual environment of streets start from the function of streets, choosing streets with different classification criteria such as daily life street, traffic street and so on as research objects. However, I think it is reasonable and interesting to analyze from the texture of the visual plane to the visual space.

Therefore, combined with my previous analysis of the historical process its' corresponding texture, I select different streets within different urban textures in Shanghai and Milan to analyze (***Typical street texture comparison between Shanghai & Milan*** *Figure 19*). I chose three typical streets in Shanghai: The first is the Nanjing Road Pedestrian which is a Commercial Pedestrian Street, it has a long history and was once in the concession area. The second street is Miyun Road, it inside the workers' residential area built during the period of Economic Reform and Opens up in China; the third one is in the Pudong New Area, along the Huangpu River. A wide street named Puming Road between high-rise residential.

Similarly, two streets were chosen in Milan. The first is the busy commercial street, Corso Vittorio Emanuele II, which also connects the Milan Cathedral Duomo with Piazza San Babila in the historical area. The second is the living street in the old residential area where I live now, via Canaletto.

Typical street texture comparison between Shanghai & Milan *Figure 19*

Shanghai	**Milan**
Commercial pedestrian in the city center	
Nanjing Road Pedestrian 	Corso Vittorio Emanuele II 
Living street with pedestrian and traffic	
Miyun Road 	Via Canaletto 
Puming Road 	Via Enrico Falck 

Elaborated by Author

Use the method of Figure-Ground diagram to express the different urban texture environments in which the streets are located. Among them, white represents the street, black represents the block and architecture, expresses the diversity of urban street organization, and strengthens the visual characteristics of different urban textures.

Due to the strict control of the sunshine interval, the residential buildings layout in Shanghai Workers' Village are mostly dominated by this rule, and the north-south orientation is unified, the architectural forms are almost identical too. Milan's residential districts are more diversified in architectural layout, mainly forming enclosed blocks and street texture. The scale of China's neighborhoods is always much larger than that in Europe, especially in the high-rise areas, the urban texture much looser.

Shanghai and Milan, which have strong differences in street spatial patterns, have created distinct Street visual environment, in which the visual perception of urban residents is also different. Based on the above analysis of the historical background and urban texture of the two cities, combined with the specific location, function, historical environment and location in the city, this paper selects the streets with similar backgrounds in Shanghai and Milan, starting research from the visual characteristics of people, to analyze the characteristics of the visual environment of the streets and evaluated it.

The first group is Nanjing Road Pedestrian in Shanghai and Corso Vittorio Emanuele II in Milan. They are both busy commercial pedestrian streets in the city center. They connect well-known historical sites of the city, bearing many human and many visual activities, so that both have good research conditions. The second group is Miyun Road in Shanghai and Via Canaletto in Milan. They located in the non-central residential areas of the city, they are all living street contain pedestrian and traffic. The flow of people on these streets is less than that of the previous group, but they are the street that the surrounding residents must pass each day which has strong living atmosphere. These streets are significantly different from the previous group in visual environment characteristics, which avoiding the duplication of street research content.

Based on my exchange experience of studying in Milan, this paper will analyze the street Corso Vittorio Emanuele II in Milan more deeply. And chose the Nanjing Road Walkway as a comparative object, but Nanjing Road in China are not able to

obtain actual research data now. So, in this paper, I will use my past experiences and available information, conduct possible comparative analysis. In the future, possibly deeper research will be carried out.

■ TYPICAL CASE STUDY IN MILAN

Kevin Lynch pointed out “Most people experience the city by walking or driving on streets” (Lynch 1960). He believes that people's understanding of the city begins with an understanding of the street, pointing out that the street is the main factor in people's perception of the city. The experience of street space directly affects the individual's perception of the city.

With the distance of urban residents to go to work is getting farther and farther, people spend more time on the streets every day. Because of the increasingly serious greenhouse effect and environmental pollution problems, the government vigorously promotes public transport. More and more people begin to walk or ride bicycles, or walk to the nearest subway station to travel, carrying out daily commuting activities, increasing the opportunity for people to walk in the streets every day. Therefore, the importance of streets to urban space has been self-evident.

American journalist and writer Jan Jacobs published “The Death and Life of Great American Cities” in 1961, reflecting on the development and status of urban streets, discussed the "life and death" of cities, affirmed the importance of streets for urban vitality in cities. She emphasized looking at the city from the perspective of human being, in order to arouse people's re-examination of the streets. She compares the street to the blood of urban life and more than just a passage for traffic. She said” When we think about cities, the first thing that comes to mind is the streets and squares. If the streets are vibrant, the city will be vibrant, if the streets are dull, the city would be dull (Fuller and Moore 2017).”

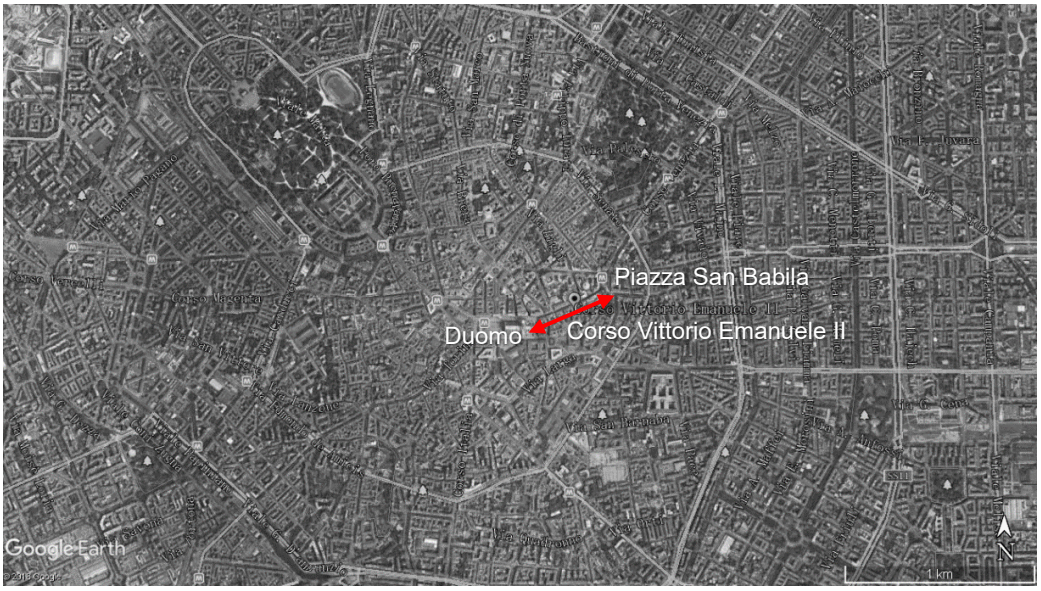
Therefore, studying the visual environment and feelings of urban streets is worthwhile for improving the image of the city and restoring the vitality of the city. I choose Corso Vittorio Emanuele II to study the objective visual environment of the street and the subjective visual perception from the perspective of visual characteristics of the human eye.

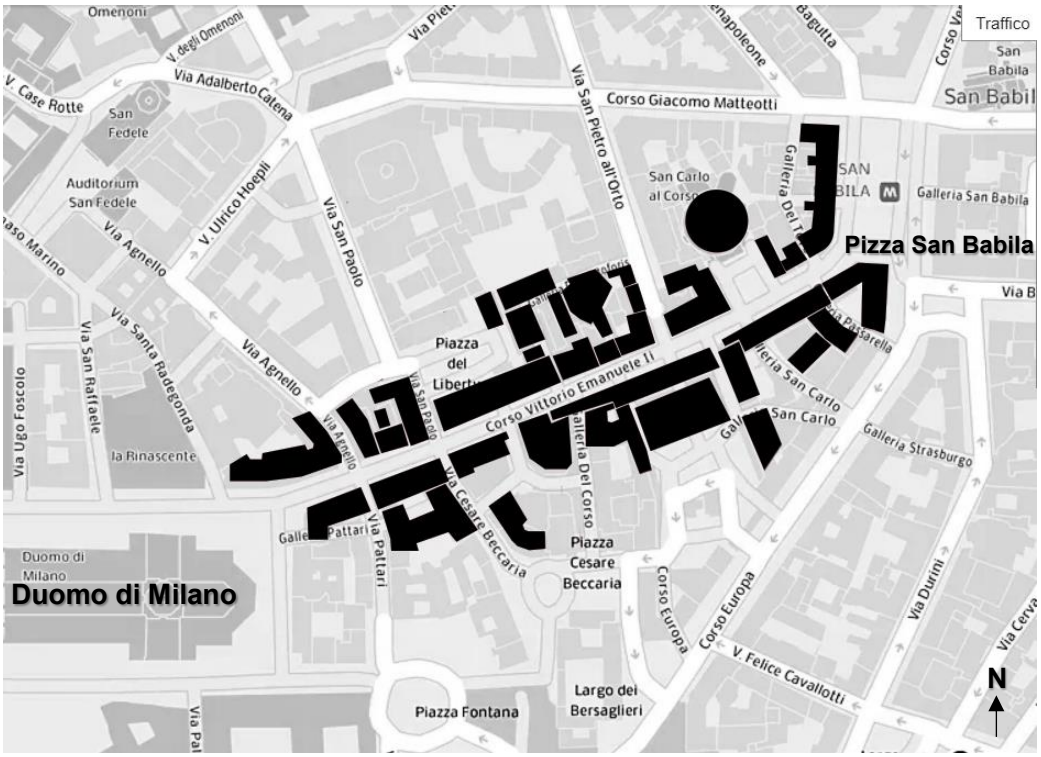
● General introduction

Corso Vittorio Emanuele II is one of the liveliest shopping streets in the city which is a pedestrian with spacious arcade constructed after 1953, and it has become the

favorite city stroll for citizens and tourists alike. The Corso follows a Roman thoroughfare, connects Piazza Duomo and Piazza San Babila (shown in ***Location of Corso Vittorio Emanuele II*** *Figure 20*), along the road located the church of S.Carlo al Corso which is a neoclassical structure completed in 1847, this historical street was been much loved by Milanese artists in the nineteenth century.

Location of Corso Vittorio Emanuele II *Figure 20*





Source: Google Earth, Elaborate by Author

The street is a pedestrian street without traffic, and the total length of the street is about 400 meters (data measured from Google Maps), the width is about 13meters (measure by footstep and Google Earth). It's in the historical center, surrounded by many historical buildings, such as Duomo di Milano, galleria Vittorio Emanuele II, Basilica San Carlo al Corso, Basilica di San Babila, etc. Their architectural styles, including Gothic, Baroque, Renaissance and other typical Italian architectural styles, all of them have important cultural value. Nowadays, this historic center has become the most prosperous area in Milan, with large numbers of commercial brands, a huge flow of people and rich visual activities.

Users of commercial pedestrian streets conduct activities and visual observation at low speeds. Compared with urban main roads, urban express roads, community streets and other street types, the purpose and orientation of commercial pedestrian are clear and definite. Due to the concentration of many commercial formats in a relatively limited area and the impact of high rents, the stores need to maximize the commercial value of land, thus forming a highly intensive business layout model. Landscape elements closely related to business behavior - Logo, facade decoration, show windows, exhibits, shop signs, ground paving, street furniture and so on - have been presented in a centralized manner, showing significant visual richness.

- **Visual Spatial analysis**

The spatial scale of the commercial street directly affects the visual experience of the people who shopping in it. The street Corso Vittorio Emanuele II is 400 m long and 13 m wide (shown in ***Scale of* Corso Vittorio Emanuele II** *Figure 21*). Both sides of the ground floor are shops with arcades, the format include retail, repast, entertainment and department stores. The bottom floor of the

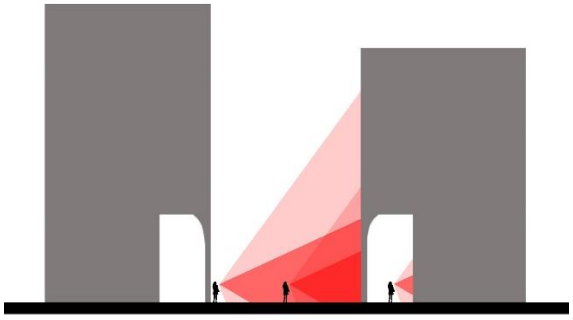
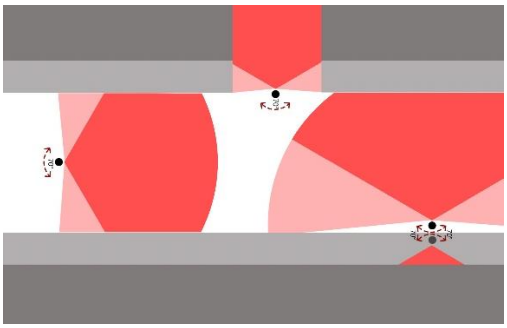
Scale of Corso Vittorio Emanuele II *Figure 21*

Source: Google earth, Elaborated by Author

building on both sides of the street retreats into an arcade with a height of 8 m and a width of about 4 m. The shop is distributed inside, and people in the arcade can freely shop, socialize and pass, reducing the heat and the impact of rainfall.

After obtaining the objective spatial data of the street, overlay the human eye visual data above on the street spatial data, to analyze the visual characteristics of pedestrians in the street. Through defining the line-of-sight range of fixed viewpoint, we can get a street interface that is easy to observe at a specific viewpoint position. Therefore, the interface with a high visual value of the street can be obtained, and the key consideration and optimization can be carried out when the visual environment of the street need to be improved.

Human Eye Characteristics overlap on street spatial data *Figure 22*

Vertical and interface	Horizontal and plane
	

Elaborated by Author

As shown in the ***Human Eye*** **Characteristics overlap on street spatial data** *Figure 22***,** the vertical angle of the human eye is 50 degrees, the downward angle is 75 degrees, and the head can be easily raised 25 degrees upward. By using these data as the standard, drawing the vertical line of sight on a fixed viewpoint in the street to show the visual range people can get. According to the standard of 62 degrees left and right for human eyes and 35 degrees left and right for head to rotate easily, drawing the visual range of horizontal line of sight.

From the vertical map on the left, ① for pedestrians walking in arcades, shop display windows show the most attractive visual point; ② For those who walk in the middle of the street and stay on the side of the colonnade to view the street, the bottom floor of the building is the easiest to observe and visually attractive interface; ③ In

addition, when the pedestrian looks up on the side of the colonnade, it is easier to see the whole picture of the street building, and people can grasp the whole architecture and view of this street.

From the horizontal line-of-sight plane on the right, we can see that:① the human eye can grasp more visual directions in the horizontal direction than in the vertical direction. Pedestrians' sights in the arcades on both sides are limited to the window, the shop entrance, the top of the arcade, and some visual objects across the street; ② Pedestrians in the center of the street have a wide view, but due to the dense columns of the arcade, the observation of the interior of the arcade is limited, but they can still see the windows and shop logos through the arcade; ③ Pedestrians lean on one side of the colonnade, turning the head left and right can easily obtain a wide view, grasp most of the scenery on the street, and the whole scene of the street.

Scenes from different perspectives *Figure 23*

Vertical view scene	Horizontal view scene
① 	① 
② 	② 
③ 	③ 

Photography from Author

Building aspect ratio

The building aspect ratio is the total width of the sidewalk and lane to the height of the building on a street. It is a representation of the vertical dimension of the street interface but could not reflect the continuous change of the visual interface of the street.

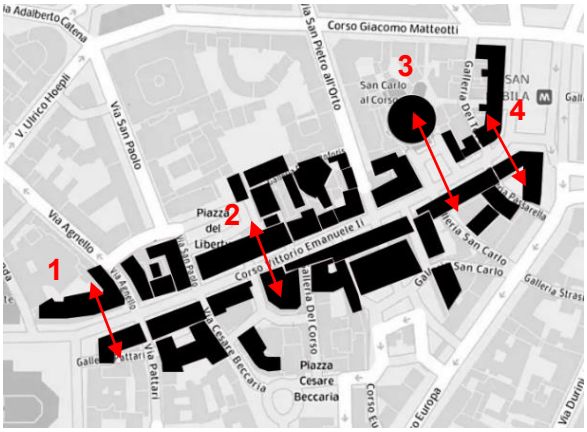
In Alan Jacobs' book "Great Streets", he summed up through examples that the aspect ratio of good streets is mostly between 1:4 and 1:0.4. This kind of space has a good sense of space enclosure and gives people a visual sense of safety (Jacobs 1993).

Ashihara is a master who studies the scale of external space. In his book "The Aesthetics of townscape", he discussed the influence of different aspect ratios on people's psychological perception (Ashihara 1983).

He set the width of the street to D and the height of the building's exterior wall to H. Through his observation, when D/H>1, as the ratio increases, the vision gradually produces a feeling of being far away. When it exceeds 2, it produces a feeling of wide vision; when D/H<1, as the ratio decreases, the vision produces a close feeling; when D/H=1, the balance between height and width is achieved, and people have the best visual experience in the street. Besides, according to W. Hegemann and E. Peets research, when D/H=2, the street person's perspective is 27° which can see the whole view of architectures in street (Myers, Hegemann et al. 2008).

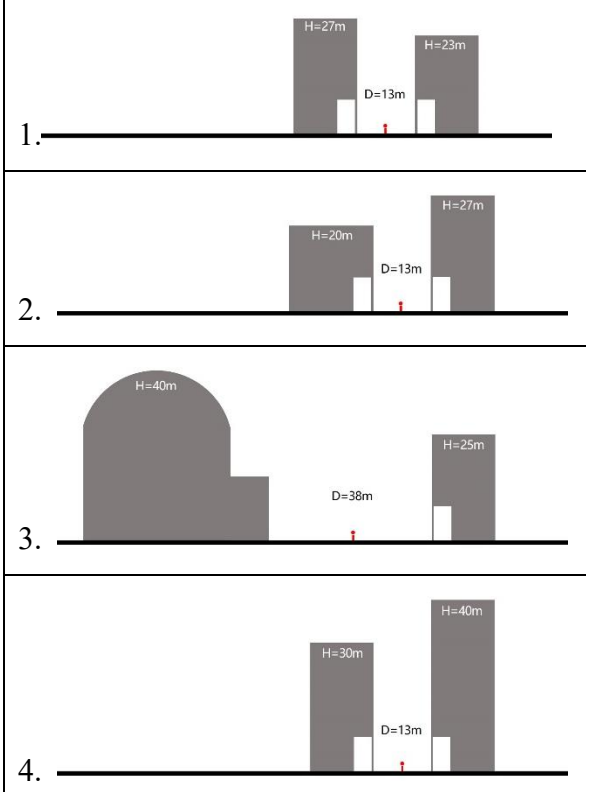
The height of the street Corso Vittorio Emanuele II is basically 20-30 meters, and the width of the street is about 13-15 meters. Apart from on Church of S. Carlo al Corso，the street combined a 25-square-wide piazza, the rest height and width of the street are evenly distributed. I selected four locations where the height of the building changed slightly and the width of the street was enlarged, made the profile and measure the height D and the width H. The calculated D/H is 0.52, 0.55, 1.11, and 0.37 at four places, and the D/H of the street is maintained at 0.5 (shown in **Different aspect ratio icons in the street** *Figure 24*). However, due to the retreat of the two floors on both sides of the street, forming the arcade on both sides, the actual space experience is much higher than this value, basically has a more comfortable space aspect ratio. Through the investigation, it was found that walking in the street can see the whole of the street building. In general, it does not give a narrow visual experience, and the space feels more comfortable.

Different aspect ratio icons in the street *Figure 24*



Data from: Google Earth and Author filed measurement

Figures Elaborated by Author

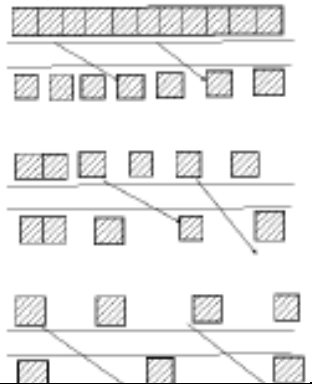


Street interface density

Interface density is the ratio of the projection width of buildings on both sides of a street to twice the length of the street. When the interface density is 0, it means there is no building enclosure on both sides of the street; When the interface density is 1, it means that both sides of the street are covered with buildings.

Alan B. Jacobs (1995), comparing and summarizing the great streets, found that the interface of successful streets is similar, and the larger the horizontal distance between buildings, the weaker the sense of space limitation (shown in ***Interface density and sense of space*** *Figure 25*). Other scholars' research shows that the "interface density" of streets is more comparable than the "scale characteristics" (周钰/ Zhou Yu 2012).

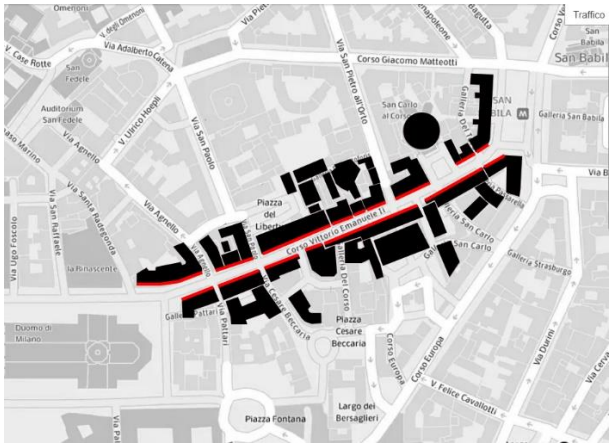
Interface density and sense of space *Figure 25*



Source: “Great streets” (Jacobs 1993)

The interface density can not only indicate the degree of enclosing of the street interface, but also the degree of visual continuity of the street interface. The higher the density of the street interface, the more continuous the street is. That is to say, the more buildings are built in the same length. The richer the form, style and color of the building are, the more "visual changes" people receive in unit time, and the better the visual effect people can get.

Location and density of street interfaces *Figure 26*



Street length: 407m

Streets' interface length on both sides: 676m

Density of interfaces:

676/407*2=0.83

Data from Google Earth, calculated by Author

Figures elaborated by Author.

For Corso Vittorio Emanuele II, according to measurements and calculations, the total length of the street is 407 meters. The distribution of the interfaces on both sides of the street is as shown in ***Location and*** **density of street interfaces** *Figure 26*, the total length is 676 meters. The calculation shows that the interface density of this street is 0.83, which shows a continuous visual interface and rich visual changes of the street.

Visual transparency

Alan B. Jacobs (1995) discusses the importance of street facade transparency for social interactions and people's psychological perceptions in the great streets and is considered one of the best street features. Stamps emphasized that open spaces in which people can see things are rather significant and physical and visual permeability in the

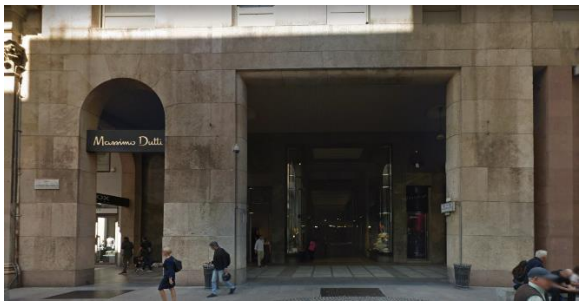
space is effective in creating a feeling of confidence (Stamps III 2005). There are also many pieces of literatures in worldwide that study street facade features through street facade transparency (Ewing and Handy 2009).

Facade transparency refers to the ratio of the horizontal length of the permeable building street in each street segment to the total length of the building interface along the street. The transparency of street facades can be divided into four categories according to the transparency of doors and windows in the underlying buildings. The first category is storefronts and places with fully open doors; the second category is transparent glass windows and fences; the third category is glass windows with visible objects; and the fourth category is impervious solid walls.

Although this indicator has nothing to do with vision, such physical properties can reflect the possibility that streets can be visually transparent. Some scholars have proved through experiments that the transparency of the street facade is positively correlated with the sense of transparency of the crowd, that is, the higher the permeability of the street facade, the higher the evaluation of the transparency of the crowd (韩玲/ Han Ling 2015). Facade transparency is the degree to which people see things on both sides through doors, windows and fences, and is the basis of people's visual penetration. The transparent street facade can expand the street space, sight through the building facade, people see the elements outside the street space itself, and feel the richer street culture and connotation.

Through field research and observation in Corso Vittorio Emanuele II, I found out the status quo of several different degrees of facade penetration. Through live photography of the facade, compared and analyzed the visual perception and visual transparency of different transparency facades.

Facade transparency and visual transparency *Figure 27*

	The building facade is completely transparent; the material is glass, no columns in the inner facade the columns in the outer facade is deft. Very transparent on visual; the shop inside can be completely seen through the glass wall. The thin column hardly affects the pedestrian's sight.
	The building facade is relatively transparent; with a high elevation, a large glass window, and a large outer gallery. Comparatively transparent on visual; Through the window and arcade can see some activities in the shop, the shop logos influence the view
	The building facade is completely transparent; the open passage is completely transparent, and the shop next to it is glass wall. Impassable on visual; dark curved channels make the sight unobstructed, large outer Gallery pillars block shops and seriously affect sight.

Photography from Author

Therefore, building with transparent facades are easier to achieve visual transparent, but transparent facades do not necessarily mean that the sight must be unblocked, it should be considered in combination with the environment of the street and the affiliation of the building. For new streets, in order to achieve a transparent visual sight, it is not necessary to completely pursue the transparency of building exterior walls, visual environment can be beautified through sight, decoration, etc. to improve visual perception; For the streets that need to be upgraded, some possible minor changes can be made to change the current situation of visual congestion and block and give pedestrians a better visual and psychological feeling.

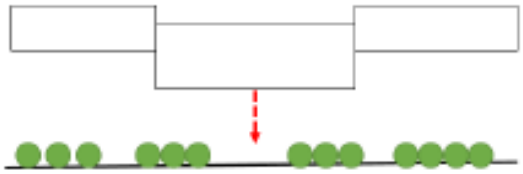
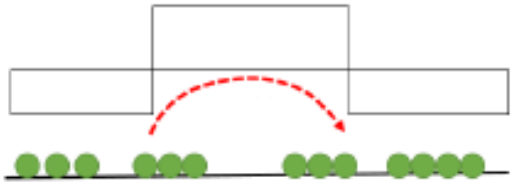
Enclosed space

The “negative space” of the street is a space that protrudes which creates a visual and psychological dead angle, while the “positive space” can hold people around, giving them a sense of security.

There is a theory called “Prospect-refuge” confirmed that which developed by Jay Appleton, an English geographer and academic in 1975. In his book, the Experience of Landscape, he proposes that humans seek out to satisfy an innate desire when reviewing a space — to have opportunity [prospect] whilst being safe [refuge].

This stems from evolutionary survival, where the predator must be able to see their prey without being seen. The theory suggests that spaces we find most acceptable to be in present us with great opportunity, yet we must be in a place of safety at the time.

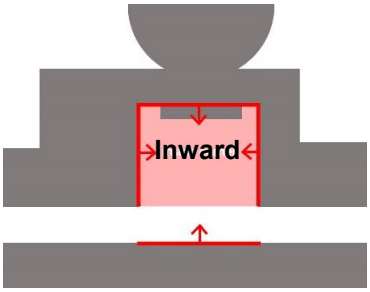
Negative space and positive space in street *Figure 28*

Negative space	Positive space
	

Source: Elaborated by Author

In street Corso Vittorio Emanuele II, there is a typical inside corner which is the piazza San Carlo. People gather here, relax along the edge, lean back against the wall or the corridor of the building, and look at the open square, which conforms to the theory of “prospect-refuge” and has an excellent visual perception experience.

Piazza in Corso Vittorio Emanuele II *Figure 29*

Photography from Google map, Figure elaborated by Author

● Visual elements

The pedestrian street is a complex visual complex with dense landscape elements. Han M H et al. (2011) consider the visual elements of the street include architectural space, street sketches, crowds and vegetation. I combined the investigation of Street Corso Vittorio Emanuele II and roughly divided it as follows:

Building facade

For street space, architecture is its main spatial boundary. Therefore, the facade of the street building plays an important role in forming the physical space and visual corridor of the street — In the landscape visual corridor of the pedestrian's direction, the buildings along the street account for vast majority of the space surface, and the rest are the road surface, the sky and the end of the street (shown in ***Visual scenes of building facades on both sides*** *Figure 30*).

Visual scenes of building facades on both sides *Figure 30*

The blue area is the building facades. It accounts for about three-fifths of the total scenes.

Photography from Author, Elaborated by Author

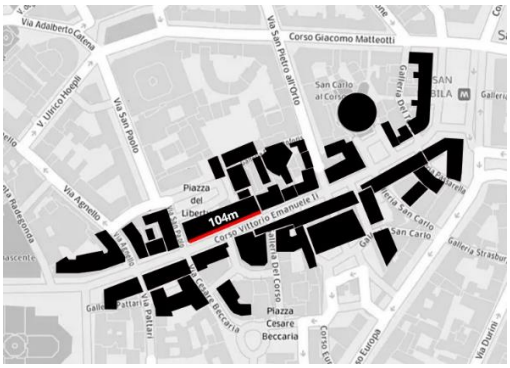
The building in street Corso Vittorio Emanuele II is a multilayer building. The facade style of the buildings is mostly classical European style, include Gothic, Baroque, Renaissance, Neoclassical style and so on. The buildings are symmetrical in architectural form, with clear lines and elevation decoration, they present elegant and romantic visual feeling.

Building facade as an important visual element of street also reflects the attraction of the quality of the bottom part of the building to people. Campos et al. (2003) of the Space Syntax Company analyzed 17 pedestrian environmental factors in the City of London and found that the activity level of the bottom floor interface is a key factor affecting street pedestrian flow.

While we walk through the ground floor, the rhythm, materials, colors of the building's facade and the people around, largely determining whether our walk is fun and vitality. We can find this same rhythm on attractive commercial streets around the world: there are 15-20 stores per 100m, which means that every 4-5 seconds pedestrians will have a new experience (Gehl 2013). Conversely, long, closed walls and dull facades convey the signal of "moving forward" and not necessary to stop.

Through a survey of a 104-meter-long building facade on Street Corso Vittorio Emanuele II (shown in ***Number of stores in certain distance*** *Figure 31*), it is calculated that there has sixteen consecutive storefronts on both sides, and pedestrians could have a rich and continuous visual experience on the building facades in the street.

Number of stores in certain distance *Figure 31*



Elaborated by Author

The visual importance of the facade of a commercial pedestrian street is also reflected in the maximizing the display of commercial content. Within the pedestrian visual height and comfortable visual field, the attention to the storefront and window of the building facade has become the most important visual activity. Some elegant display windows, through good visual design, become an important visual element to attract pedestrians. But the opposite is that some commercial advertisements have problems with excessive density, improper location or ugly styles, it has produced serious visual occlusion and impact, but also has a negative impact on the visual quality of street landscape. Combined with the investigation and observation of street Corso

Vittorio Emanuele II, I selected some typical negative cases to show the negative visual impact (shown in ***Typical negative facade*** *Figure 32*).

Typical negative facade *Figure 32*

		
Giant advertising occupies a great field of vision for pedestrians on the street, giving people a feeling of depression	The curtains of the trademark blocked the pedestrians sight looking up into the arcade, Weaken the feeling of visual transparency.	Logo hanging outward on the street, hindering the sight of the end of the street, affect the visual continuity of the building façade.

Photography from Author

Outdoor seats

Some restaurants in the street set up outdoor seats. They have comfortable environment and pleasant scenery. People can fully enjoy their leisure time, which provides an excuse for those who watch the city life. The time people spend in the seat can always longer than drink coffee, because people's purpose is to entertain and have a rest, enjoy urban space and the pleasure of watching other people.

Except the good environment to watching others, the coffee shop and the seats' area are generally well designed, so itself also can be a good visual object for people walking across the street. Restaurants or bars on the street can use outdoor space and transform it only after they apply to the local government and pay a certain fee. They use plants, umbrellas and even glass roofs to create semi-outdoor space. And the quality

of this space is related to business, so the shop will be very careful to manage this space and make it has high visual quality to attract pedestrians.

Resting space and outdoor seats on the street are very important. If there are seats on the street, it will always have people to sit, which will trigger the visual activity of staying and watching. If benches and other seats can provide good looking view, then their utilization rate will certainly be guaranteed. Relevant research on stools and seats in urban space shows that seats with the best view of urban life are far more frequently used than those without "watching activities" (Gehl 2013). We could divide Street seats into three categories: Payment seats belongs to bars, formal seats (benches and chairs) and auxiliary seats (steps, low walls and stone piers).

Following is a survey of the existing seats on street Corso Vittorio Emanuele II (***Distribution and use of different types of seats*** *Figure 33*). The location and number of various seats are known, and the use condition of people and visual activities during their stay are observed.

Distribution and use of different types of seats *Figure 33*

Photography from Author, Figure elaborated by Author.

Pavement

The pavement of street constitutes the bottom of the street landscape space. The change of its material, color and form can enhance the richness of the visual landscape, and at the same time, it can echo the color and material of the buildings along the street. The paving texture of street floor can also refine or strengthen the effect of space.

In case streets Corso Vittorio Emanuele II, uniform and continuous ground pavement is used to control the overall sense of street space (shown in ***Main Pavement on Corso Vittorio Emanuele II*** *Figure 34*). In important areas, changing the paving material and the application of decorative patterns to improve the aesthetic taste and visual richness of street space. Through the different paving material, the different space areas in the street and the arcade are given corresponding visual hints.

Main Pavement on Corso Vittorio Emanuele II *Figure 34*

	
Apart pedestrians and bicycles from the sight	Coordination with historic building in style
	
More aesthetic paving style in small area	Circular paving texture at the intersection

Photography from Author and Google map

Natural

The natural elements of the street mainly include green plants and water bodies. The quantitative characteristics of street greening are important indicators for measuring the natural landscape of the built environment. In street Corso Vittorio Emanuele II, green plants are rare to see, only a few green plants can be saw at outdoor coffee seats area to improve visual beautification (shown in ***Figure 35***).

Plants in Streets *Figure 35*

Photography from author

Colors

Color is art for beautifying people's lives, more and more valued by designers. Marx once said, “The feeling of color is the most popular form of general aesthetic feeling.” Human color perception is not only related to visual, but also related to the brain; not only related to material but also related to psychological. Colors have no emotions at all, but they have the function of communicating emotions when they relate to human living space, which brings people rich visual and psychological feelings.

We could use colors to design different environment, express different style space, give people different aesthetic interest. We should skillfully use the influence of color on our visual psychology to create comfortable and aesthetic street landscape scenes.

Colors visual perception in Corso Vittorio Emanuele II *Figure 36*

	
The main color of the first half of the street is warm yellow, blends well with the color atmosphere of the Duomo nearby.	The main color of rest of the street is gray, visually coordinated with modern window and decorative materials.

Photography from Google map

● Human activities in streets

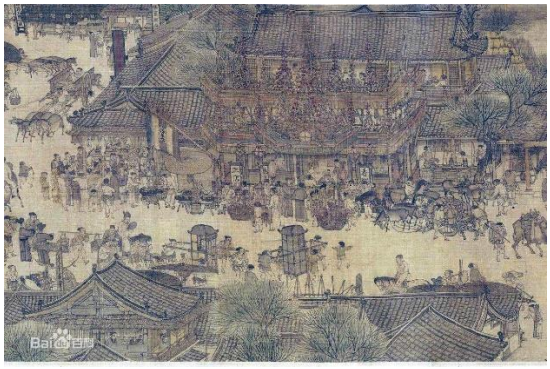
For the study of the visual activities of people on the street, it is very necessary to understand the behavior of people. After all, only when people's activities exist, can there have the visual observation. From ancient times to the present, the street space of the city has been used as a meeting place, commercial market, transportation place and so on. Cliff. Moughtin believes that the street is the living room of the city, the function of the street should include people's communication, street performances, ceremonies and so on (Moughtin 2007). The various functions of urban streets determine that there will be many human activities in urban streets, which are full of diversity and complexity, and overlap and transform between purposely walking, shopping, rest, staying and communicating.

There is some inevitable connection between the quality of the street environment and people's walking activities. There is relevant research proved (Isaacs 2000) that aesthetically attractive streets can promote people's walking activities (Cerin and Leslie 2008). Compared with the community with general aesthetic level, the community with higher aesthetic level had 16% more walking activities, while the community with lower aesthetic level had 41% fewer walking activities (Ball, Bauman et al. 2001).

In the West, especially during the Middle Ages and the Renaissance, the street environment has good quality and very humanistic. In the design of the street, the humanistic thought is implemented by considering the change of the sight landscape during the walking process. If we look at the medieval city from a contemporary perspective, we can find that its street scene is very vibrant and of great aesthetic value. Similarly, in China, urban streets and lanes also show a bustling scene, carrying the daily activities of people from all rank of life.

As shown in the following ***Comparison of Chinese and Western street paintings*** *Figure 37*, I choose the Chinese famous paintings "Along the River During the Qingming Festival" and the paintings on the streets of Milan. They recorded the overall appearance of the city streets and the activities of people from all rank of life on the streets. Both paintings show a lively and crowded scene depicting the behaviors of people such as business, traffic, crowd gathering, and communication.

Comparison of Chinese and Western street paintings *Figure 37*

Along the River During the Qingming Festival	Il Teatro alla Scala visto dalla Corsia del Giardino
Zeduan Zhang, 1085-1145	Angelo Inganni, 1807-1880
	

Source: baidu.com, milanoneicantieridellarte.it

After the Second Industrial Revolution, the development of motor vehicles such as automobiles has had a profound impact on street construction. Urban streets seem to

be gradually away from people's walking activities and daily life, and the streets have lost their original vitality.

Since 1960s, people have gradually realized that the pedestrians are the main body of street design, and the people-oriented concept began to be applied to street design. Scholars such as Jane Jacobs, William White, and Ashihara Yoshito began to study the street environment from a human perspective. Since then, the design of street buildings that meet people's visual needs and the design of street places that meet people's social communication needs have gradually become an important part of street environment research.

Classification of human activities

According to Gehl. Jan’s research, there are three main types of classification of people’s activities on the street (Gehl 2011):

Necessity activity (Daily, consistent)

Selective activity (Entertainment and occasional)

Social activities (Communication between people)

Necessity activities are activities carried out by people for the necessary content such as study, work, and life. Such activities are driven by strong purpose, such as learning, going to work, commuting, medical treatment, delivering parcels, meeting with others, shopping, etc. This kind of activity is dominated by traffic and pays more attention to the efficiency of traffic. Such activities are very important and necessary in life, so the conditions under which they occur are seldom affected by material and external environment. Just like whether it's windy or rainy, children have to go to school every day during non-rest time, and workers have to go to work, the participants have no choice on this kind of activities. Necessary activities are usually the most important type of activity for many people every day.

Selective activities are activities that occur only when participants have the willing to act and have the feasible time and appropriate external environment. Compared with the necessary activities, such activities are higher-level activities that are more than necessity. It has leisure, entertainment, appreciation and other attributes, and is not an

indispensable thing to do in life. Therefore, in order to produce selective activities, the quality of the surrounding environment has a greater impact, of which visual quality is an important part. For example, the possibility of enjoying the beautiful scenery and taking a walk in a stiff and dirty square is greatly reduced, which is far less likely than that in a beautiful, clean and tidy place. In commercial pedestrian streets, selective activities occupy a large proportion, and only when the environment is suitable for shopping, walking, squatting, toileting, etc., it is possible to attract and gather large number of people.

Social activities are collective activities in which people participate as members of society, such as greetings, discussions, chats, games, and so on. Social activities are the extension of necessary activities and selective activities. They usually evolve from the above two types of activities, but their necessity is weaker. A certain scale of necessary activities and selective activities are the necessary conditions for social activities. As long as the conditions of necessary activities and spontaneous activities in the public space are improved, social activities will be indirectly promoted. In a commercial pedestrian street or other external space, as long as many people are active in the same space, there may be a possibility of contact with each other. There are also many passive contacts between seeing and hearing in the commercial street: observing other people and watching what is happening, etc. This form of appropriate, non-targeted contact is ubiquitous and the most common urban social activity. We could strengthen social activities and enhance the connection between people in the streets by improving the quality of the environment and increasing the attractiveness of the environment.

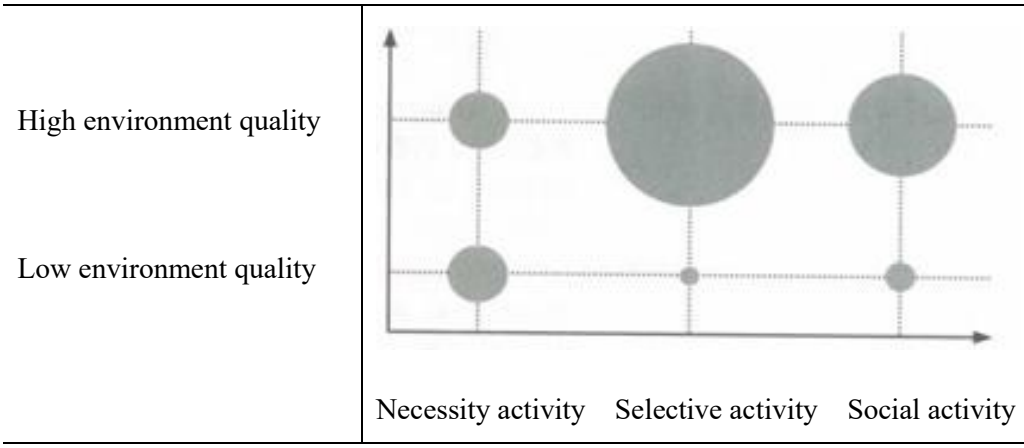
Activity types and environmental quality

As mentioned earlier, necessary activities are not disturbed and changed as long as the environment does not change significantly because of their attributes of accomplishing a given purpose or task, therefore, such activities are less affected by the quality of space, while selective activities require a better external environment. So, when the quality of the outdoor space is so good, only the necessary activities will occur as usual, and selective activities become few. When the outdoor environment is comfortable and has a high visual quality, the comfortable space environment triggers

people's desire to stay and appreciate, so that more people will actively participate in street activities, and the social activities will come with it logically.

This shows that environmental quality has a very large impact on the number and type of activities in public spaces. In commercial pedestrian streets, a dynamic, rich and pleasant visual environment can reduce the rhythm of essential activities and increase the chances of selective activities.

Relationship between types of activity and environment quality *Figure 38*



Source: "Cities for people" Gehl. Jan

Specific human activities

1. Walk

Walking is the most important human activity on commercial pedestrian streets. Pedestrians' journey is a process of finding interesting targets, changing observation positions, and accompanied by conversation and diet. It is divided into two types: walking in purpose and walking in random.

Walking in purpose contains necessary elements, such as through, addressing and searching for established shopping goals. This kind of walking usually has a fast pace, pursues efficiency, has obvious planning routes, and does not pay much attention to the street landscape.

Walking in random is a slow-paced, incoherent walking movement where pedestrians often stop and go, accompanied by watching and talking. The route and direction of such walking are easily changed by the point of interest, and it is easy to stay, rest and watch at some food outlets, rest spots, shades, and street performances. Free walking does not pay attention to the efficiency of the passage. Pedestrians have a deeper understanding of the surrounding environment and are susceptible to it.

Here the figure shows some walkers in street Corso Vittorio Emanuele II (***Figure 39***).

Walkers in Corso Vittorio Emanuele II *Figure 39*

Walk & Watch	Walk & Watch
Walking to pass, the sight was attract by display window	Crowded street, visual attention is on avoiding crowds
	

Photography from author

2. Rest

It's a selective activity. It is a process of relaxation for commercial pedestrian street users, including stopping and sitting. Recreation usually occurs after a certain time of walking and encountering a suitable place to stay, and it is usually combined with enjoying the surrounding scenery and past pedestrians, tasting portable food, waiting for shopping companions and other behaviors. In this process, the person turns from the motion state to the static state, the visual system does not need to pay attention to the information along the way and find the appropriate travel path in the crowd, thus,

more energy could be used to observe the surrounding scenery and experience the environment characteristics, and pay the highest attention to visual landscape.

Different rest behavior in Corso Vittorio Emanuele II *Figure 40*

Rest & Talk	Rest & Watch & Talk
Rest on the plinth, talk to each other	Rest in outdoor bar, watching the pedestrians
	
Rest & Watch & Talk Rest by pillars, attract by the church and stay to watch and communicate High visual attention to landscape	

Photography from author

3. Watch

One of the most important and attractive aspects of the city is the view of city life. Whether we walk, stand or sit down, we are continuing a very common activity: watching people. In order to improve the quality of the city, we need to provide more

things for people choose to see. While we observe people in any activities on the road, we are attracted to stop and watch them more detailly, even to stay or to participate in.

In “A visual approach to park design”, Albert used the form of illustrations and texts to mention that the design needs to consider the behavior of “people watching others” (Rutledge 1981). Watching activities of pedestrians on streets are not unique, usually accompanied by rest and marching, and at different observation points, the viewing objects will change too.

This kind of watching behavior even improves the security of the street to a certain extent. Jacobs. Jane put forward new planning terms of “observers on the street” and “eyes on the street”, discussed the importance of residents’ attention to public space for street safety, and emphasized the role and effect of street life on crime prevention.

Different watching behavior in Corso Vittorio Emanuele II *Figure 41*

Watch & Rest	Watch & Talk
Rest and watch the other side of street	Watch the display window and talk
	

Photography from author

- **Comments**

From these analyses, we can know that the blocked sight, long distance, and too high layers, which prevents people from watching and communicating to each other. For the existing visual environment of the street, the possible optimization suggestions are:

1. Increasing central vegetation coverage, providing a place to rest means more views, and the possible communicate. I conducted a practical investigation on the streets in sunny and rainy days, during the week and on weekends, and found that the climate environment has a great impact on the visual activities of the streets. In the midday sun and rainy weather, pedestrians gather in the arcades on either side, only few pedestrians in the streets. As a result, crowded people, congested sight and normal traffic are affected, people must always pay attention to the road ahead of them in order to prevent trampling or collision with others. In such an environment, visual activities on the street are greatly reduced, such as watching people, watching streetscapes, and staying close to the window display (the line of sight is obstructed by dense crowds or there is no space to stand and appreciate). In addition, green plants can also alleviate the visual fatigue caused by the stimulation of various shop signs, providing a comfortable and rich visual environment for the streets.

2. There are too few public seats on the street, only a few of them appear in the second half of the street. More seats mean more possible viewpoints and longer visual dwell time, which will inspire more people to interact, socialize, watch and other activities to enhance the vitality of the street.

3. At the intersection of some arcades, the light is dim, which makes people lose the desire to go shopping. The less deserted road crossings also reduce the possibility of people entering. This vicious circle will weaken the vitality of the street. It is recommended to increase lighting, design shop windows, and increase visual appeal to increase street traffic.

■ COMPARATIVE CASE IN SHANGHAI

The comparative case in Shanghai is Nanjing East Road. Because it is impossible to conduct field research, we can only search for information through past experiences and internet, Google Earth and other ways to make a brief comparative analysis. The content of the analysis is the same as above, in order to find out the difference of visual environment and pedestrian visual perception between the two streets which are also the commercial pedestrian street in the city center.

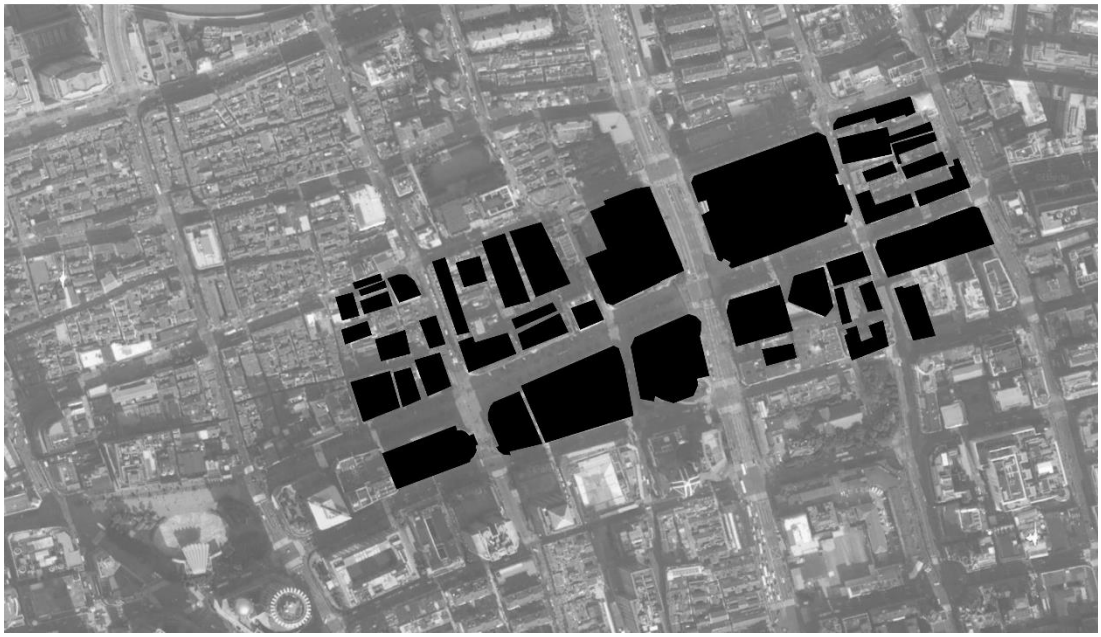
● General introduction

Nanjing East Road is one of the top ten commercial centers in Shanghai, located in the center of Shanghai (shown in ***Location of Nanjing Road Pedestrian*** *Figure 42*). There are many shops on the street, and the business is booming, due to the past colonial experience, the architectural styles of the streets are diverse, showing the characteristics of the integration of Chinese and Western cultures.

Nanjing Road Pedestrian is one of the commercial pedestrian streets in Nanjing East Road, and it is also the object of our comparative study. The street is 1033 meters long and 18-28 meters wide. It is laid out asymmetrically. Adopting an asymmetrical arrangement, with the 4.2-meter-wide "Golden Belt" mainline running through the entire pedestrian street. The “Golden Belt” is equipped with urban public facilities such as chairs, shopping booth, information desk, advertising boards, sculptures, light, garbage bins, etc., and has a variety of flower pond. The pedestrian areas on both sides are flat and open, without any obstacles, leading directly to the store.

Nanjing Road was once the main east-west traffic trunk road in Shanghai. After it became a pedestrian street, its original traffic function was replaced by other roads. During its more than 100 years of development, it has created a variety of styles of buildings, scattered buildings are high and low, and the interface is uneven.

Location of Nanjing Road Pedestrian *Figure 42*

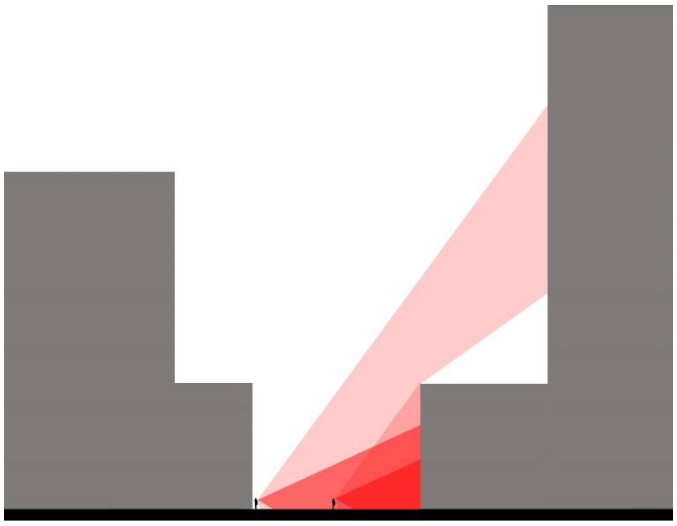
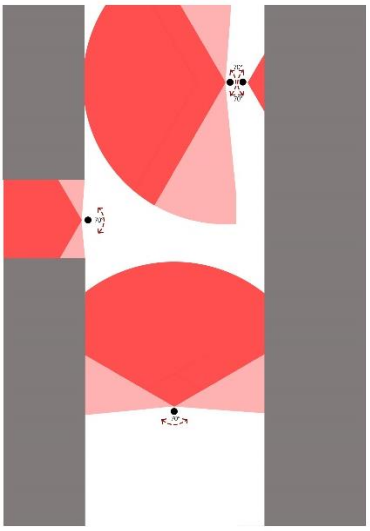


Data from Google Earth, elaborated by author

● Visual spatial analysis

Combined the visual characteristics of human eyes, the following figure ***(Human Eye Characteristics overlap on street spatial data*** *Figure 43*) can be obtained by overlapping the sight angle with street physical spatial data.

Human Eye Characteristics overlap on street spatial data *Figure 43*

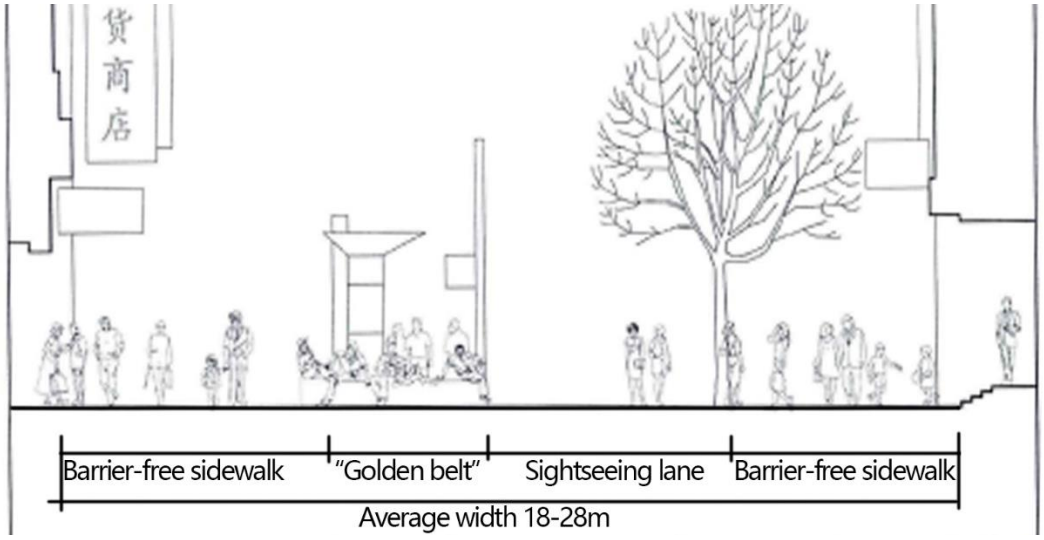
Vertical sight and interface	Horizontal sight and plan
	

Elaborated by author

There are many high-rise buildings in the street. Although there is a certain distance from the street, and the podium building in the street is controlled at a low level, the visible high-level pedestrians on the street still have the occlusion and oppression of the line of sight. Pedestrians do not have a full view of the street, the space for them is not completely controllable, resulting a visually psychologically uncomfortable feeling. Horizontal vision can completely cover the width of the street, pedestrians can see things on both sides of the street, and they have a good grasp of the visual environment in the horizontal direction of the street.

From the typical section on Nanjing Road Pedestrian shown in ***The typical* section *on Nanjing Road Pedestrian*** *Figure 44* we can see that the spatial structure of street cross-section can be roughly divided into three parts: barrier-free wide sidewalk connected to the entrance of shops on both sides; A "Golden belt" with rest seats, lamps, signs and other facilities in the middle; Wide electric sightseeing trail next to the "Golden belt" and the other side of the walkway. In addition, a row of trees planted in the middle of the electric sightseeing trail and the sidewalk is arranged to block the visual oppression of pedestrians from some high-rise buildings.

The typical section on Nanjing Road Pedestrian *Figure 44*

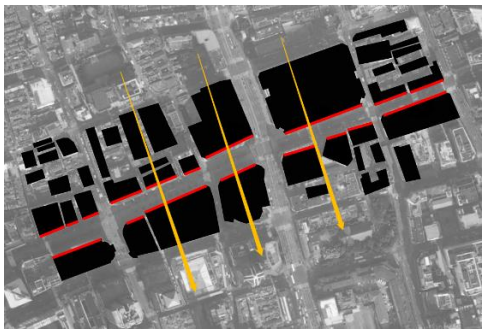


Source: baidu.com

Building aspect ratio

According to the ratio of street width (D) and building height (H) which is D/H of Awara Yoshishin, the average width of Nanjing Road Pedestrian Street is 18m to 28m, but the number of buildings and heights are not the same, so the D/H value will change.

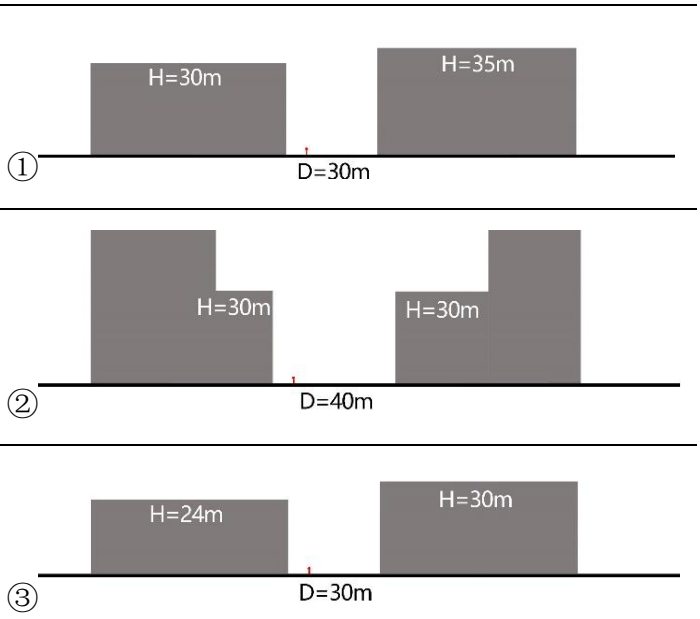
Different aspect ratio icons in the street *Figure 45*



Source from:

Google Earth,

Elaborated by author



As shown in the figure, three sections are selected to calculate the D/H value of the pedestrian street. In general, D/H≈1, the height and width of the street are relatively comfortable, which is very conform to people's visual habits. In some D/H>1 area, the overall space is relatively wide, which is easy for consumers to feel away from each other, effectively alleviating the space pressure on the pedestrian street, so that consumers' visual physiology and psychology can be relaxed, but at the same time, not too wide to make people feel empty and achieves a more comfortable visual experience.

Street interface density

The interface density indicated the degree of enclosing of the street interface, and the degree of visual continuity of the street interface. For Nanjing Road Pdestrian, according to data on internet and calculations, the total length of the street is 507meters. The distribution of the interfaces on both sides of the street is as shown in ***Location and density of street interfaces*** *Figure 26*, the total length is 750 meters. The calculation shows that the interface density of this street is 0.74, which shows a continuous visual interface and rich visual changes of the street. But compare with the ratio of Corso Vittorio Emanuele II in Milan which is 0.83, the visual interface changes are not so rich.

Street interface density *Figure 46*

Street length: 507m

Streets' interface length on two sides: 750m

Density of interfaces:

750/507*2=0.74

Elaborated by author

Visual elements

Based on the existing data and the basic conditions of the street, the analysis of visual elements proceeds from the following points:

Outdoor seats

The design of the rest seats on the pedestrian street is mostly in the form of a combination, and some are designed in combination with flower tree ponds. The combination of seats has many benefits, allowing pedestrians to freely choose the direction and orientation of the vision, and follow the principle of "prospect-refuge" to form a personal defense space. This kind of spaces also makes it easy for pedestrians to rest and communicate. But the granite seats on the pedestrian street are made of stone, it will be hot in summer and cool in winter. In the cold winter without sunshine, this kind of seat gives a sense of chill.

Combination of pedestrian street seats *Figure 47*

Source: "Nanjing Road Pedestrian Mall psychological analysis of the environment design", Xulan

Pavement

The pavement of Nanjing Road Pedestrian uses large color blocks to divide the space. The pavement difference is mainly manifested in three functional areas, namely the "Golden Belt" rest area, the pedestrian flow area and the road junction area. The rest area is paved with red-gloss granite, which is brightly colored and clearly distinguishes it from the warm grey pavement of the pedestrian flow area, enhancing the visual recognizability of the area. The color of the pedestrian flow area is consistent with the color of the overall architectural environment. Both are gray and white, providing

pedestrians with visual continuity and transition, reducing the visual stimulation of the environment to pedestrians. The road junction area is clearly distinguished from the rest area and the pedestrian flow area by color. Its paving design plays a visual warning role for pedestrians, reminding them and drivers to go slow, thus ensuring the safety of their walking.

The pavement condition in Nanjing Road Pedestrian *Figure 48*

Source: baidu.com

Natural

The plant of Nanjing Road Pedestrian is mainly the use of movable green box. The flower ponds are surrounded by benches. There are a variety of plant configurations are adopted for built scenery, small trees, shrubs, flowers and even landscape stones are used to form different visual landscapes (shown in ***Figure 49***).

Different planting form in Nanjing Road Pedestrian *Figure 49*

Source: "Nanjing Road Pedestrian Mall psychological analysis of the environment design", Xulan

Colors

The analysis of the spatial color of Nanjing Road Pedestrian is mainly analyzed from the main color of the environment and the auxiliary color of the environment. The main color of the environment is the basic tone of the whole environment, which basically determines the tone and style of the whole space, is the main part to a unified tone. The auxiliary color of the environment plays the role of embellishing the environment, increasing the rhythm of color change in the space, adding vitality to the space of the pedestrian street.

The main color of the pedestrian street mainly includes architectural colors, paving colors, and plant colors. As shown in ***Figure 50,*** due to historical reasons, there are many historical buildings along the street. Although the height of the building, the number of floors, the proportion of windows, and so on are different, the exterior walls of the building took masonry yellow and earthy colors as background color, adding cold colors such as blue and white, together to form the color spectrum of the pedestrian street. Maintaining the integrity of the architectural facade and the sense of belonging of the street. The pavement is mainly designed in warm colors, mainly in red and warm gray, with a small proportion of gray and black as a warning for functional partitions. The main color of the plant is green, dotted with red, yellow and purple. The overall tone is very warm, allowing consumers to feel the warmth of the pedestrian street environment.

The main colors of the Nanjing Road Pedestrian *Figure 50*

Architectural color	Paving color	Plant color
		

Source: baidu.com

The auxiliary color of the environment mainly includes advertising sign color, street furniture color, sculpture color and so on (shown in ***Figure 51***). The color of street furniture is in harmony with the environment of pedestrian street, which creates a comfortable visual environment; Street signs are rich in color. Some shop signs over-emphasize the purity of color. They are in large size and prominent in color, and the same advertisement is keep repeated at many intersections. Moreover, some stores use red electronic displays to promote goods, which is more prominent in the environment and cause visual discomfort due to excessive irritation to the consumer's vision.

The auxiliary colors of the Nanjing Road Pedestrian *Figure 51*

Street furniture	Street signs	Sculpture
		

Source: baidu.com

Generally, the color of street visual environment is rich and harmonious for pedestrians. In view of the excessive prominence of color with individual advertising signs, it should be transformed into a more moderate advertising color, which is in harmony with the overall visual environment.

- **Comments**

1. The commercial trade and service functions of pedestrian streets have been largely concentrated in large indoor shopping malls now. The continuous store and window display have decreasing, these interesting visual facades of the near-human scale are the main objects for street continuity and visibility. Therefore, the visual richness of the Nanjing Road Pedestrian is reduced.

2. High-rise buildings on both sides of the street and large advertisements and shop signs in the street block most of the view of pedestrians looking upward. The view of pedestrians looking up in the sky becomes smaller and smaller, which seriously affects the appropriate proportion of street sections and spatial transparent.

3. In street space, the outlines formed by such landscape elements as shop signs, lighting, advertising and activity shading occupy and overlap with each other, forming dense visual perception and transmitting endless visual information. However, crowded overlapping, homogeneous dense landscape elements bring pedestrians nowhere to focus on, unable to form a clear appreciation theme and progressive appreciation process, the attractiveness and interest of the landscape will be affected.

4. At the beginning of the construction, the facades of the buildings along the street are mostly uniform in tone and similar in style, but the commercial propaganda content added to the building entity has completely changed the appearance and color of the original facade. Moreover, the propaganda colors of some commercial brands, various colors and strange colors continue to appear, and the uniformity and coordination of commercial street vision are seriously damaged. At the same time, the architectural style of the street and the overall street visual atmosphere will also be seriously affected.

■ CONCLUSION

In summary, through the visual environment analysis of typical streets in Milan and Shanghai, I understand the visual environment characteristics of different streets. Through the analysis of the environmental factors related to visual perception, the spatial scale and visual characteristics of human eyes are overlapped to clarify the street space for pedestrians, which can better perceive and grasp the scope of the street environment. This provides a range for the design and transformation of the street visual environment, and redesign within the perception range of human eyes.

Through the case analysis, the entities affecting the pedestrian's visual perception in the street are analyzed from two aspects of space and element. Spatially, through literature research, It is clear that street aspect ratio, interface density, visual permeability, positive space has a greater impact on visual perception. Combined with these spatial data in the case streets, the current situation of visual perception in the street environment is analyzed. Combined with the results of the computational analysis, specific recommendations for specific optimization are given. For example, if the street aspect ratio is too large and the human visual perception is too depressed, we can reduce the visual pressure and redefine the D/H value by means of plant shelter or aerial arcade in the bottom space; if the street aspect ratio Too small, people's visual experience is too broad, without a sense of encirclement and security, you can layer the street cross-section design, weaken the visual perception of streets' wide, in order to achieve a suitable street visual environment.

Through case studies and literature readings, the facade of the street is also an important aspect of pedestrian visual attention. A good street needs to be designed to display the space of the stimulating source through the design of the pedestrian street space interface, so that consumers can get a full range of visual experience. At the same time, it emphasizes the visual order and continuity of the facade. The lack of order and fragmented facade will also bring a negative visual experience to pedestrians.

Through the classification study of pedestrian activities in the street and the analysis of pedestrian activities in specific cases, I knew the diversity of pedestrian position. This is closely related to the street streamline arrangement and the layout of rest seats. It is the key to the design of street visual environment to provide space places

for consumers to stop, watch and participate in communication activities, and to provide people with visual, audible and touchable sensory experience. In the design and renovation of the street, it is necessary to pay attention to the landscape effects of different possible viewpoints.

For the color, pavement and greening of the street, we must follow the principle of order, integration, simplification and balance of visual psychology, and present many elements and colors in a harmonious environment. Among them, the color should follow the principle of the main color and attached color. For some signs that are too jumpy and conspicuous, and easy to stimulate the pedestrian's vision, it should be modified and removed to prevent damage to the overall atmosphere of the street. The green planting combined with the seats can provide a shaded resting place for pedestrians, while the natural colors can also relax the pedestrian perception. Pavement design can give visual hints to pedestrians, which is a method of dividing space places by visual perception.

In a word, to study the landscape environment of streets from the perspective of human perception is to put people first, emphasize the good visual experience of people walking on the streets, and strive to achieve the goal of safety, comfort and fun visually. At the same time, through the research, it provides a method to avoid, reduce and offset the bad urban visual environment design for the existing street landscape that needs to be upgraded and transformed.

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■ APPENDICES