

# Research and Design Strategy of Pedestrian Space Quality in Shanghai under New Data Environment: A Case Study on Lingyun Community

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## ABSTRACT

People-oriented is an important requirement of new urban design. In Shanghai Xuhui district Lingyun street as the main research place, research based on multidimensional, multi-channel sources of data information, combined with the present design and transformation needs new urban streets, new demand in an ageing society as the priority, tries to transform rigid traditional street planning and design, make new data environment and environmental design, street space, the urban planning combined with the application, And then put forward a new data, livable, humanized urban street walking space strategy.

**Keywords:** urban-type; ageing; community; development strategy study; Shanghai

## 1. INTRODUCTION

In *Aesthetics of the Street*, Yoshinobu-ashihara defines pedestrian space as "the space in which all walking takes place, which in cities should include pavements, footbridges, commercial pedestrian streets, river walks and boulevards, and should also include residential pedestrian systems, stations in cities, dockside distribution plazas, and recreational assembly plazas."

A healthy and orderly street life cannot be achieved without the support of a positive urban development environment, a rational social structure and a high quality population. As the main spatial carrier of street life, the pedestrian space is the most influential and reflective part of street life and urban spirit.

In recent years, along with the rapid rise of concepts such as big data, "Internet E+" and data cloud computing, human society is entering a new information era. High precision, wide coverage and multi-dimensional data and information are changing the way we perceive cities, think, act and interact with each other. These changes are putting forward new demands for changes in the use of urban public space, spatial environment and operation methods, and are also putting forward multi-dimensional and higher

requirements for the evaluation of the comprehensive quality of urban public space. How to use new ways of accessing data to accurately study changes and quickly solve various problems in urban public space has become the key to research nowadays. Therefore, it is important to use the new data environment to create a comprehensive quality evaluation system to quickly identify and analyse the current problems of urban public space, and to propose methods to respond to them in a timely manner, so that urban public space can return to being people-oriented and effectively guide people to participate in urban public activities and improve urban vitality.

Our team conducted a study on the quality of pedestrian space in Shanghai, with the aim of breaking the status quo of "one thousand streets", responding to the Shanghai Urban Master Plan (2017-2035), and completing the "Community Micro-Renewal Design for an Age-Friendly Society". The answer to the questionnaire is In the context of the new urban science and the new urban data environment, we conducted social surveys and assessments, analysis of the current situation, and collation of big data, including analysis of the current supporting facilities, analysis of the current nodes, analysis of the distribution of street places, analysis of rail transportation, 24-hour dynamic

population distribution, and analysis of the origin and destination of the population.

## **2. NEW URBAN STREET DESIGN AND UTILIZATION NEEDS**

### ***2.1. Urban design transformation under smart city and new urban science***

With the deepening of China's urbanization process, a series of macro policies represented by the National New Urbanization Plan increasingly emphasize the people-oriented and quality-oriented development path. The new characteristics of space quality oriented, three-dimensional analysis as the perspective, and fine control as the starting point are the inevitable needs of China's overall built environment into the humanized and fine development stage. Predictably, because in the new period for deepening the space quality pursue, simply focus on past form design and beautification of urban design will be gradually abandon, concerns over urban design will gradually shift from "aesthetic form" to "humanistic quality", and the implementation of urban design control from the 2 d plane to a fine "in 3 d space". These changes make the pursuit of urban design more in line with its original goal -- the creation of beautiful places and public life. This demand change also puts forward higher requirements for data acquisition and analysis support technology of urban design. (Ye Yu, 2019)

### ***2.2. Urgently develop aging-friendly blocks that meet the aspirations and needs of the elderly***

With the coming of the aging society, the surrounding green space in urban communities is indispensable for the elderly, because it is the main place for the elderly group to have recreational activities. Studies have shown that elderly people living in urban green space can relieve negative emotions and effectively improve their mental and physical health. The quality of open space and internal facilities in the old communities can not well adapt to the change of age structure of this population, and the corresponding demand of the elderly for green space has also changed. The development of urban green space environment in line with the wishes and needs of the elderly has become a major issue of social and public policy. (Xu Bo, Wang Huan, 2020) Shanghai is the first city in China to enter the aging society, and it is also a large city with the highest aging degree in China. The latest data shows that in 2019, the elderly population aged 60 and above in Shanghai was 5.181,200, accounting for 35.2% of the total registered population, up 0.8 percentage points from 34.4% at the end of 2018. On the basis of the aging population in Shanghai, the old communities have become the focus of community reconstruction. According to the latest data, the average

age of lingyun community in the west of Xuhui Campus of East China University of Science and Technology is 47.8 years old. Although activity centers and facilities for the elderly in Lingyun community have been implemented to a certain extent, there are still many problems to be solved and improved in the face of travel for the elderly.

### ***2.3. Car-based street space and scale need to be transformed***

The design and scale of street space gradually began to be based on means of transportation, especially private cars, while the needs of people were gradually ignored. The street walking space gradually became a subsidiary of the street motor traffic space, and a large scale of dehumanization appeared, and posed a security threat to people's street life. However, in the design of pedestrian space, the living function of pedestrian space is neglected in order to achieve the fluency of pedestrian space, and the traditional street life gradually disappears, forming potential social problems to some extent. In addition, the big cities to build, iconoclastic, image engineering construction design planning problem, but also caused the street space lost pleasant space scale and the unique local characteristics, presented the situation of "thousand street color".

## **3. LITERATURE REVIEW**

Easy refers to the urban space dominated by walking, which includes safety, portability, walking comfort and accessibility[1]. Easy advocates safe and comfortable walking space. Walking in pleasant natural landscape can reduce mental stress and improve happiness[2]. During the 13th Five-Year Plan period, China's pension industry continues to develop, and the construction of a livable environment for the elderly continues to advance. The State Council issued the "Healthy China Action (2019-2030)", which emphasizes building a livable environment for the elderly and realizing healthy aging. Therefore, urban planning aimed at elder friendliness should include planning studies and specification formulation on feasibility[3].

At present, the research on "easy space" based on resident friendliness mainly includes quantitative and qualitative research. Duan Degang takes Baoji city as the research site and adopts the qualitative research method. In view of the objective reality that the current landscape planning is difficult to implement, he tries to stabilize the disordered urban space in an orderly "landscape control unit" through the approach of full coverage of landscape control[4]. On the contrary, Lin Zhenfu used quantitative research methods to practice the urban planning of Xiamen city, and summarized the development direction and mode of Gulangyu community function through the study and judgment of

gulangyu community development process, current situation and trend[5]. Other scholars used qualitative and quantitative systematic analysis methods to study topics such as regional cultural remodeling and summary of the status quo of landscape features. For example, Ding Shaorean et al. analyzed the changes of traditional street features in Zhongshan city from a cultural perspective[6], and Wang Liang et al. used analytic hierarchy process to quantitatively evaluate the current situation of shenyang urban street design[7] And so on.

In the era of big data, various data channels are changing with each passing day, and the data are becoming more and more refined and in-depth. However, there are still relatively few studies on micro-scale space, namely street space. Big data is used to study urban commuting, spatial structure, spatial quality and vitality of multi-center cities, which mostly belong to macro or meso scale. For example, the open space between pocket parks and buildings is very challenging. It is this human-scale space that carries People's Daily life. Our team goes deep into it and tries to improve the livable space from the details.

## **4. TAKE LINGYUN COMMUNITY AS AN EXAMPLE**

### **4.1. Background**

Lingyun Community is located in Xuhui District, Shanghai, starting from Old Humin Road and Guilin South Road in the east, reaching Hongmei South Road in the west, separated by Dianpu River in the south and humin Road in the north, covering an area of 3.58 square kilometers. The subdistrict is a residential community of population introduction, with 104,000 residents, including 90,200 registered residents, 13,200 migrants (excluding foreigners) and 565 foreigners. The population density is nearly 28,700 people/square kilometer. There are 1195 community units.

### **4.2. Research methods**

#### **4.2.1. Policy review**

Combined with the literature review, this paper sorts out the current policies. The "Shanghai 2035" master plan highlights the people-oriented principle and puts forward the "15-minute community life circle". The aim is to greatly improve the convenience and accessibility of communities and ensure targeted delivery of public services. Through improving the construction of public transportation facilities, to achieve seamless connection of catering, shopping, leisure and entertainment. This coincides with the research purpose of this paper. Each 15-minute circle has its own green space, activity space for the elderly, fitness facilities, parking lots, schools

and so on, so that residents can barely leave the "circle" in their daily life. For the elderly community 15-minute life circle construction focus on according to the physical characteristics of the elderly "appropriate medicine".

#### **4.2.2. Quantitative analysis**

First, through street observation and visits, the team made a series of calculations on the characteristic factors, activity status and activity types of public space, counted the per capita venues for residents' activities, and analyzed the needs and action rules of residents, tourists and other groups. After that, the method of questionnaire survey was adopted to issue unified questionnaires at each node of Lingyun community. A total of 400 questionnaires were issued, and 309 valid questionnaires were recovered.

#### **4.2.3. Model construction method**

On the basis of visualization, using baidu street View large-scale street view data and POI data analysis to establish a universal mathematical model. Use a number of software to create a comprehensive quality evaluation system to quickly identify and analyze the status quo of urban public space, so as to put forward humanized and practical countermeasures, pay attention to the people-oriented principle of urban public space, effectively guide people to participate in urban public activities, improve the vitality of the city.

### **4.3. The exhibition and analysis of data**

#### **4.3.1. Interviews and questionnaire results**

Interviews revealed that there is a high level of encroachment on the walking paths, with many areas being blocked by obstacles that make it difficult to pass baby pushchairs and tricycles.

In addition, the team focused on asking about road problems in the Lingyun community, mainly focusing on: serious transit traffic disruption; poor public awareness of traffic; lack of resident management; and lack of community management.

Through the questionnaire survey, we learned that most of the residents have lived in Lingyun Street for more than 10 years, while a few have lived there for 5-10 years; elderly people mainly travel by public transport and walking, while a few use private cars and bicycles.

#### **4.3.2. Model construction results**

The following diagram is based on the visualization, using Baidu Street View's large-scale street view data and POI data analysis to build a generalized

mathematical model. Based on the function of crawling crowd concentration areas in apps such as VWAP.



**Figure 1** The generalized mathematical model

Based on the results of the interviews and questionnaires, combined with the visualisation of the streetscape images, the problems identified are mainly in the following areas: railings: the railings lack aesthetic appeal and have a single function; the height difference at the street: there are more height differences at road junctions, causing inconvenience to the disabled and elderly; non-motorised parking: the pavement is used as a parking area for non-motorised vehicles, leading to mixed traffic and inconvenience to residents; small parks: there is a lack of facilities for people to interact and rest in small parks; the open space in front of the vegetable market: the open space in front of the vegetable market has not been fully developed and the building grey space is under-utilised; the height difference at the station: the station facilities are old and there is a height difference, causing inconvenience to pedestrians getting on and off the train.

## **5. RENOVATION STRATEGY**

### **5.1. Renovation of routes**

The renovation will be led by Lingyun Road and supplemented by Jiachuan Road to make the whole section accessible for all ages. The height difference between intersections and shops will be broken down, and on top of making the whole section accessible, street landscaping will be added from a child's point of view to create points of interest for children on foot.

### **5.2. Pedestrian space transformation**

The barriers caused by the difference in height of the road surface are broken down; additional space is provided for non-motorised parking; landscaping facilities are added to the roadside as a means of remedying the situation of non-motorised parking; and barrier-free paths are added alongside blind corridors for the disabled, elderly and children.

### **5.3 Node renovation**

On the basis of the accessibility of the entire road section, selected nodes have been transformed based on the behaviour of people on the road section and are flexible for use by residents of all ages at different times of the day. For example, in the case of the Lingyun vegetable market, a large area of open space has been transformed into a small pocket park, providing a resting space for grocery shoppers while accommodating the parking of non-motorised vehicles.

### **5.4. Modern facility design**

#### **5.4.1. Interactive screens**

Designed to be accessible to all ages, the design takes into account the different needs of people such as the blind, disabled, elderly and children. Internet interactive screens are set up at fixed points along the road to provide instructions on various community and amusement facilities for various groups of people such as passers-by and visitors.



**Figure 2** The interactive screens

#### **5.4.2. RFID audible signal alert**

Modifications to traffic lights and zebra crossings at junctions have been carried out, combining needs with today's internet big data and other technologies using Bluetooth and RFID for audible signal alerts, online accessibility maps and other ways to further deepen the programme.

#### **5.4.3. Accessibility map**

The online accessibility map is constantly being improved based on accessibility modifications, so that people with travel disabilities can plan the most convenient and smooth travel routes based on actual traffic, avoiding peak travel times and areas where travel is difficult.



Figure3 The accessibility map

#### 5.4.4. Pavement zoning

The design is adapted and improved for different needs, dividing the resurfaced walkway into four parts: the amenity belt, the accessible walkway, the blind walkway and the building front drive. The railings have been modified to take into account the viewpoint characteristics of different groups of people.



Figure4 The pavement zoning

## 6. CONCLUSION

**6.1.** The organic integration of street pedestrian space research with the New Urban Science is applied, using the discipline of New Urban Science as an organic guide for research studies, combining new data from emerging hotspot disciplines with the study of urban public space.

**6.2.** To grasp the inner spatial structure of a city through spatial perception breaks the traditional research method under the previous land function zoning, and focuses on the individual and collective behavior affected by urban space.

**6.3.** The study of pedestrian spaces in ageing neighbourhoods creates ageing-friendly neighbourhoods, not only in the broad sense of pedestrian spaces in neighbourhoods, but also by conducting further in-depth research into older people and the phenomenon of ageing.

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