Quantitative Study on the Street Interface Form of Beijing Historical District —Taking Dashilar as an Example

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Abstract
Streets are not only the skeleton of a city, but the label of the quality of a city's public space. Taking Dashilar, a historical district in Beijing, as the research object, this paper makes a quantitative study on the interface shape of Dashilar pedestrian street from three levels and 12 indicators. From the urban level, it mainly analyzes the street texture and accessibility; from the architectural level, it mainly makes quantitative analysis on the building uniformity, interface density, store density, fractal dimension, line sticking rate, transparency and openness on both sides of the street; from its own level, it makes quantitative analysis on the street curvature, aspect ratio and sky exposure. Thus, the morphological characteristics of Dashilar street interface are quantitatively analyzed. It also provides a reference for the future research on street vitality and the quality improvement of urban public space.

Keywords: Street Space, Development and Evolution of Dashilar, Quantitative Study, Space Quality

1. Introduction

1.1. Location Analysis of Dashilar Street

Dashilar street is 275 meters long. It is a famous commercial street outside the Beijing QIanmen Street. It is located in the center of Beijing and an important part of the south central axis. It is located in the south of Tiananmen Square and the west of the Beijing Qianmen Street. (As shown in Fig1~4)

Fig.1. Beijing, China

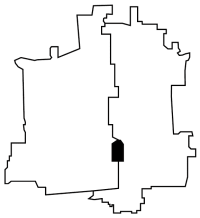

Fig.2. Dongcheng and XichengDistrict,Beijing

Fig.3. the Qianmen District,Beijing

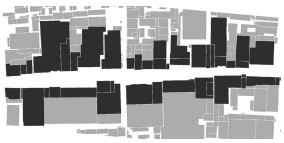

Fig.4. Dashilar Street

1.2. The Formation, Development and Evolution of Dashilar

Dashilar commercial street has a history of nearly 600 years. It rose in the Yuan Dynasty and was established in the Ming Dynasty. It flourished in the Qing Dynasty and the Republic of China, and then gradually declined due to the war. This old street with commercial legend has been developed in the continuous change of dynasties (As shown in Fig5~12), and now it has become a landmark tourist resort in Beijing in the continuous restoration and transformation.

Dashilar Commercial Street in Yuan Dynasty belongs to the suburbs outside Imperial city, and it was a place for civil and military fficials to play. Temporary shops with simple structures also appeared at the same time.

In the Ming Dynasty, Ming Emperor Zhu Di moved the palace city making the Dashilar a part of the inner city, and planned the shop, called Langfang, for investment and leasing. and No.4.Langfang is Dashilar pedestrian street at that time.

In the Qing Dynasty, Dashilar Commercial Pedestrian Street entered a period of prosperity, with more types of business forms and a wide reputation.

In 1900, Dashilar was destroyed in a fire during the Boxer movement, but the Dashilar commercial street rose from the flames and flourished again.

At the early Republic of China, with the development of industry and the completion of the railway station, the further prosperity of Dashilar was promoted to a great extent.

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Later, with the outbreak of war, the Dashilar Commercial Street lost its lively atmosphere and gradually became deserted and depressed.

In 2003, Dashilar was included in the key historical conservation area. In 2005, in order to improve the economic vitality of Qianmen area, the reconstruction of Dashilar area began. On the eve of the 2008 Beijing Olympic Games, the streets were opened to welcome visitors. Today, Dashilar is still one of the most vibrant commercial pedestrian streets in Beijing.

With the change of times and the evolution of architectural facade style, the architectural facades on both sides of Dashilar Street are a collection of traditional Chinese style, western style and Chinese and Western style. With its exquisite facade, exquisite decoration, rich business types and strong business atmosphere, Dashilar has always been one of the most dynamic commercial pedestrian streets in Beijing.

Fig.5.An Old Photo of Beijing Qianmen Street in the Late Qing Dynasty.
Photo Source: Mu Mo's Photo Diary By Ein Tagebuch In Bildern. De Alfons Von Mumm

Fig.6-7.Dashilar in The Early Period Of the Republic of China., the Flourishing Dashilar Added Many Western Style Facade.
Photo Source:Xu Chengbei. Old Beijing Variation Qianmen. Chongqing: Chongqing University Press, August 2014

Fig.8.Dashilar in the 1980s
Photo Source: haokan.baidu.com




Fig.9-12.Current Interface Form of Dashilan Street
Photo Source: Author's Own Photo

2. Urban Level

2.1. The Texture of Dashilar Street

Dashilar Pedestrian Commercial Street has been dominated by commercial forms since ancient times. The family based businesses integrate residence and shops, forming the management mode of "front shop and back factory" and "upper house and lower shop", and group layout; The buildings on both sides of the street inherit the traditional Chinese texture of streets and alleys in the aspects of scale treatment and back line treatment.

Due to the absence of a unified treatment of building backlines, coupled withthe attention paid to the "door and hall system" under the traditional Chinese ritual system, the facades of buildings along the street are prominent and concave at will.

From the plane (As shown in Fig.13~14), the whole street presents a dislocated and connected, uneven texture. Although the natural growth texture is not neat enough, it increases the sense

of hierarchy and interest of the street space. It reflects the morphological characteristics of Chinese traditional street space.

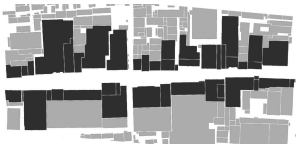

Fig.13.The Texture of Dashilar Street

Fig.14.The Texture of Dashilar District

Fig.15.Circle Range of 10 Minutes to Reach the Destination

Photo Source: Author Redraws

2.2. Accessibility

Through the analysis of the traffic around the commercial pedestrian street of Dashilar, such as the bus and subway facilities, it can be seen that the traffic facilities around the pedestrian street of Dashilar are convenient, the subway and bus stops are densely distributed, and the destination can be reached within 10 minutes from the nearby traffic facilities. Therefore, the overall accessibility is strong（As shown in Fig.15）

3. Architectural Level

3.1. The Interface Form

Camillo Sitte believes that the use of continuous interface to form a closed space is the most basic condition for the streets and squares to achieve artistic effect. The way Chinese traditional streets deal with the interface has a lot to do with their culture and etiquette system, forming a unique interface form, prominent and concave, although continuous but uneven.

The architectural facade style brings together the traditional Chinese style, western style and post-modernism style. Although the length of the street is 275 meters, the natural texture and spatial forms as well as the diverse architectural interfaces make people feel not bored but linger. (As shown in Fig.16~23)

Fig.16~23.Interface on Both Sides of the Street
Photo Source: Author's Own Photo

3.2. The Uniformity of the Street Building Interface

There are many shops on both sides of Dashilar, well-arranged, but not smooth. (As shown in Fig. 24.)

From the texture of Dashilar, it can be clearly seen that the buildings on both sides of the street are in low uniformity, and the distribution of buildings on both sides of the street is concave and convex. Through investigation, the widest part of Dashilar commercial street is 11 meters, the narrowest part is about 5 meters, and the average width is about 7 meters (As shown in Fig.25 ~27) The widest part of Dashilar street is the result of the retreat of the buildings on both sides, which can be regarded as the spatial node in the pedestrian street. The widest part of Dashilan street is the result of the retreat of the buildings on both sides, which can be regarded as the spatial node in the pedestrian street. The larger space node plays the role of collecting and distributing people and carrying out small social activities and so on.

Through the extraction of the contour lines of the buildings on both sides of the street, it can be clearly seen that Dashilar commercial pedestrian street does not pay attention to the back line and line sticking treatment of the buildings on both sides, and the randomness of the concave and convex of the buildings makes the space form of different width and well-proportioned appear in the street space.Which fully reflects the essence of Chinese traditional streets.

This kind of concave and convex change of street morphology is more common in Chinese traditional block space. This has a lot to do with Chinese traditional cultural concepts, urban planning ideas and architectural design culture.“The door and hall system “ is an important basis for Chinese architectural design. It is the embodiment of the layout and design content of different levels of buildings. In order to highlight the dominant position of the door, architects often use the method of concave and prominent layout design. which is also the direct reason for the concave and convex change of the street interface and the low building uniformity. It is also the reason that greatly increases the interest and flexibility of street space.

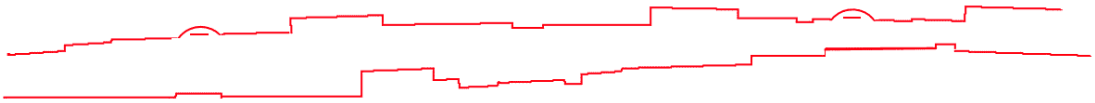

Fig. 24. Extraction of the Outline Line along the Street of Buildings on Both Sides of the Street
Photo Source: Made by Author

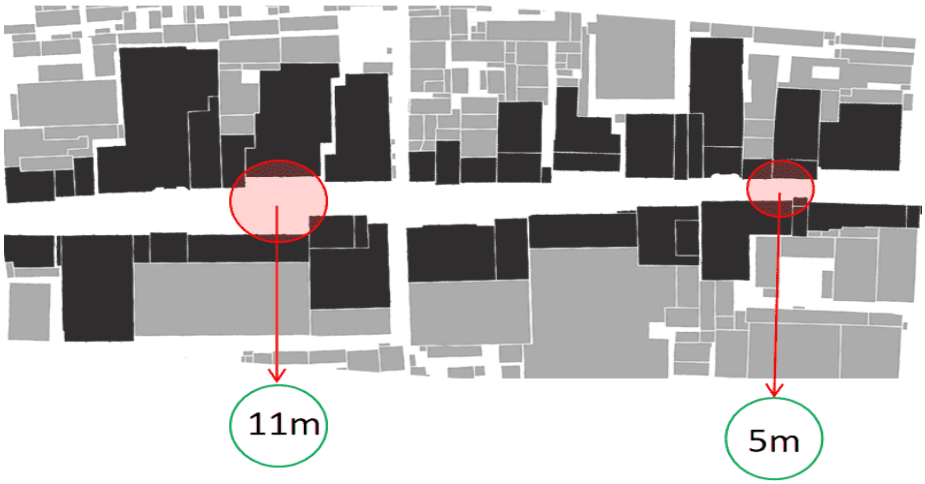

Fig. 25. The Uniformity of the Street Building Interface

Fig.26.The Widest Part of the Street

Fig.27.The Narrowest Part of the Street

Photo Source: Made by Author

3.3. Store Density

Store density refers to the number of commercial units per 100m of street length, it reflects the development intensity of the street. It can be expressed as follows:
Store density = total store number/sidewalk length ×100%

Jan Gale thinks that blocks with 15 to 25 commercial units or entrances per 100 meters are the most dynamic, and 10 to 14 are walking-friendly.

Through research, Chinese scholars believe that the store density of 7 stores per100 meters may be the threshold to attract tourists to stay. When it is lower than 7, the amount of commercial activity decreases obviously.

According to the survey, there are 42 commercial units on the south side and 41 on the north side of Dashilar Street. According to the formula, the store density of Dashilar is more than 30%.

3.4. The Open Degree

The Open degree of the street interface is used to describe the state of the street being open or closed. And some studies show that there is a negative correlation between openness and commercial activities. That is, when the openness is zero, the vertical interface on both sides of the street is continuously closed.

The density of street interface is a quantitative index to characterize the degree of street interface enclosure. The density of a street interface obviously depends on the number of buildings enclosing the street, and it is further related to the building density of the block. At the same time, the continuous street interface will be interrupted by the horizontal street. Therefore, the street network density is also one of the factors that affect the street interface density.

From the above analysis, we can see that the openness and density of street interface are a pair of interrelated quantitative indicators. It reflects the same characteristics of street interface from different aspects.

The length of Dashilar is 275 meters. In addition to the two ends of the beginning and the end, there is only one alley opening in the middle. It can be seen that the openness of Dashilar pedestrian street is close to zero. (As shown in Fig. 28.)

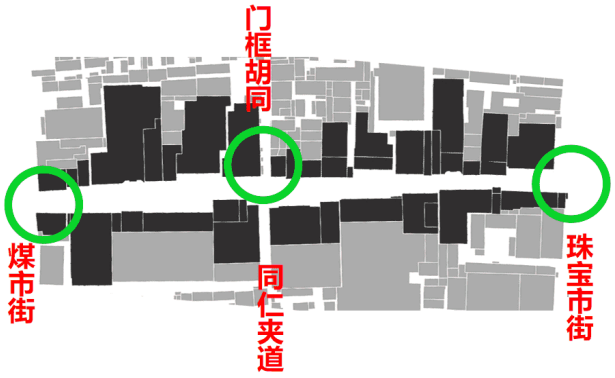

Fig. 28：Analysis on the Openness of Dashilar Commercial Street
Photo Source: Made by Author

3.5. Store Type and Function

There are 23 traditional time-honored shops in the pedestrian street, accounting for 33% of the total stores. (As shown in Fig. 29~32.)



Fig. 29-32. ：Traditional Time-Honored Shops
Photo Source: Author's Own Photo

4. The Spatial Structure Of The Street Itself

People's perception of space when walking on a pedestrian street, such as cramped, spacious, crowded, unfamiliar and balanced, is closely related to the proportion of spatial structure of the street.

Camillo Sitte is the earlier one to study the aspect ratio of spatial interface. However, Sitte studies the relationship between the scale of the square and the height of the surrounding buildings. The conclusion is that the minimum size of the square should be equal to the height of the main buildings around it. The maximum size shall not exceed twice the height of the building.

After that, in the *Aesthetics of the Ttreet*, Luranraison made a deep research on the spatial structure of the street, and clearly put forward the width-to-height ratio of street interface. The main conclusions are shown in Table 1.

2>D/H>1	With the increase of the ratio, there will be a sense of distance
D/H>=2	When the ratio exceeds 2, it will produce a sense of broadness
D/H<1	When the ratio is less than 1, with the decrease of the ratio, there will be a sense of proximity
D/H=1	When the ratio is close to 1, it will give people a more balanced feeling.

Table 1：Analysis of Street Space Structure and Pedestrian Space Feeling
Table source: Made by author

According to the investigation and field survey, The buildings on both sides of Dashilar range from 2 to 4 floors, with a height between 8 meters and 17 meters.

The width-to-height ratio (w/h=width height ratio) of Dashilar street interface includes three kinds of proportional relations:The width-to-height ratio Less than one、 greater than one and equal to one.

Different aspect ratio represents different street spatial forms, reflecting the richness of spatial structural forms of Dashilar Street and increasing the interest of street space.
Below are three selected street space nodes with different width to height ratios.(As shown in Fig. 33~36.)

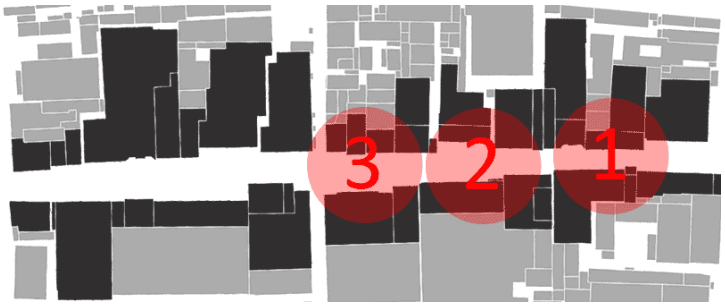

Fig. 33. Selected Three Street Space Nodes with Different Width to Height Ratios
Street Space Nodes with Different Width to Height Ratios

Fig. 34. D/H<1

Fig. 35. D/H>1

Fig. 36. D/H>1

Photo source: Made by author

5. Conclusion

As one of the most important urban public spaces, streets not only constitute the skeleton of the city, shape the urban texture, but are also the cultural carrier and spatial quality Symbol of the city. Jane Jacobs, a famous American urban researcher, once said, "when we think of a city, the first thing that comes to mind is the street. If the streets are lively, the city will be lively, the streets will be dull, and the city will be dull. "This paper takes Dashilar as an example, and studies the interface form from three levels，in order to provide a reference for the current research on the vitality of urban streets and the improvement of the quality of urban public spaces.

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