Study on the Experiences in Node Spaces of the Taikoo Li Commercial Block in Chengdu

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Abstract: This paper chooses the main node spaces of the Taikoo Li commercial block in Chengdu as the research object. Through field observation and experience, it is found that there are abundant changes in the spatial scales of these nodes; a rich variety of changes can also be found in the interfaces of node spaces which are composed of virtual and real boundaries. The utilization of grey space and the rational allocation of landscape facilities increase the spatial experience of pedestrians and attract pedestrians with different landscape preferences. From the perspective of environment experience, the node space of Taikoo Li commercial block is a kind of humanized design.

1. Introduction

Commercial blocks are public landscape space in cities. They are not only the place for commercial activities, but also the space for urban residents to walk, to recreate and to carry out interpersonal activities. Commercial blocks have the most abundant social interaction and functional layout in all urban spaces. In the area with interlaced blocks, large node spaces are often formed. These node spaces have the functions of gathering people and organizing activities. Node spaces intersect in the linear change of streets, making the process of environmental experience changeable. In order to attract people, enhance the vitality of the block and beautify the urban space, various landscape planning and design methods are adopted in node spaces. Therefore, this paper chooses Chengdu Taikoo Li Commercial Block as the research object, studies the node space of Taikoo Li from the perspective of environmental experience, and evaluates the design of node space from the perspective of humanization.

2. Overview of the Research Area

The Taikoo Li commercial block is located in Daci District. It is north to Daci Temple Road, south to the East Street, west to the Shamao Street and east to the South Street and Bitie Street of the Dongshun City. It is next to the Chunxi Road Business Circle, and can be accessed through Metro Line 2 and Line 3. The block covers an area of 70800 m^2, and is connected with the Chunxi Road Business Circle. Located between the Daci Temple Scenic Area and Chunxi Road Business Circle, the plot is concave around Daci Temple. It is narrow from east to west, and relatively wide in the south, which is the main part of the Taikoo Li business district. Therefore, the representative node spaces of the southern area are listed (Figure 1), and then divided into two categories according to the size of each area. The larger places are public spaces enclosed by buildings and streets (A, B, C, H, I, J). The areas of the three spaces of A (West Square), H (Daci Square) and I (East Square) are more than 1,000 m^2. The function of gathering places is obvious and there are many landscape facilities. The smaller places are the intersection areas of streets (D, E, F, G, K).

Figure 1. Main Space Node Distribution in Taikoo Li

3. Research Contents and Research Methods

In order to study the spatial scale and the territory sense of spaces, researchers observed the shapes, the D/H values, as well as the perimeters and areas of main node spaces of Taikoo Li block, then calculated the length values of virtual and real boundaries as well as the ratios of grey space area. The territory senses of spaces are evaluated afterwards.

To study the changes of human flow and activity richness, researchers observed the people flows and change trends in the main node spaces of Taikoo Li, namely A, H and I at different time points in sunny days, so as to evaluate whether the space is fully utilized.

In order to study the residence time and the spatial attractiveness, researchers divided the main squares of A, H, I into several units with the size of 12 m*12 m. The lengths of pedestrians' residence time in the three squares were observed in the same period of a sunny day, so as to evaluate the spatial attractiveness.

The landscape facilities and the comfort level of activities were evaluated through the investigation about the distribution density of landscape facilities in the main node spaces of Taikoo Li block.

4. Research Results and Analysis

4.1 The spatial scales and the territory senses of node space in Taikoo Li

4.1.1 The spatial scales and the territory senses

There is a rule in static spatial scale. When individuals stand in the middle of a place, the ratio between the width (D) of the site and the height (H) of the side elevation can produce different territory senses. When D/H is less than 1, people in the space will feel the sense of closure. When D/H is greater than 1 and less than 2, people in the space will feel like they are standing in the courtyard. When D/H is more than 3, people in the space will feel empty and spacious. [1] From Table 1, we can see that the D/H values of D, E, F and G in the interlaced area of streets are less than 1, representing these squares provide a strong sense of closure; the D/H values of A, B, I and K in the enclosed areas of buildings are between 1 and 2, which provides people a comfortable feeling of courtyard; the D/H values of C, J and H are larger than 3, which make people feel empty and spacious. The space H is the Daci Square with the largest area in the block.

Table 1. Spatial scale and territory sense of main node spaces

Nodes	Static spatial scale			territory sense
	D(m)	H(m)	D/H	
D	13.7	13.6~14.6	0.94≤D/H≤1.00	
E	8.4	16.0~17.6	0.48≤D/H≤0.53	Closure
F	8.1	15.3~16.0	0.51≤D/H≤0.53	
G	8.3	15.0~16.7	0.50≤D/H≤0.55	
A	18.8	13.0~15.0	1.25≤D/H≤1.45	
B	24.2	10.5~15.5	1.56≤D/H≤2.13	courtyard
I	30.3	14.9~16.7	1.82≤D/H≤2.04	
K	28.7	14.0~15.0	1.91≤D/H≤2.05	
C	38.0	10.5~15.0	2.53≤D/H≤3.62	
H	53.1	13.8~15.0	3.54≤D/H≤3.85	Open and spacious
J	40.3	12.5~16.7	2.42≤D/H≤3.23	

4.1.2 Closure of node spaces

The side elevation boundary of node space is composed of solid interfaces of buildings and other forms of interfaces such as building gaps and streets. The former is called as the "real boundary" while the latter is called as the "virtual boundary". The ratio of lengths of real and virtual boundaries is the index to measure the sense of closure. If $0 \leq L$ virtual/ L real ≤ 0.33, the sense of closure is strong. If $0.33 \leq L$ virtual/ L real ≤ 1, the sense of closure is good. If $1 \leq L$ virtual/ L real ≤ 3, the sense of closure is weak. If L virtual/ L real ≥ 3, the sense of closure is bad. The coverage degree of the top interface of the node space also affects the spatial closure. The space covered by the top interface is called as a "grey space", while the space not covered by the top interface is called as a "bright space". The alternation of the light and dark space changes pedestrians' lines of sight. Therefore, the spatial closure varies with the ratio of the light and dark areas. From Table 2, we can see that spaces B and H have a strong sense of closure, but space B has relatively more grey spaces, which enhances the closure vertically. Spaces C, I, J and K have better senses of closure. The corridor grey space also has an impact on the enhancement of space closure; the areas of grey space determine the degrees of enhancement. Spaces A, D, E, F and G have weak or bad senses of closure. These five spaces are at street intersections and have high ratios of virtual boundaries. They are mainly used as traffic nodes to disperse the flow of people, which is different from other space enclosed by buildings and streets.

Table 2. Spatial closure of main node spaces

Node	Virtual boundary (m)	Real boundary (m)	L virtual /L real	Degree of closure	Area of grey space (m²)	Ratio of grey space area (%)	Changes in degree of closure
A	74.9	83.5	1.2	weak	--	--	No change
B	21.8	72.7	0.3	strong	262.9	49.5	increase
C	33.9	76.3	0.4	good	274.1	44.1	increase
D	42.7	14.8	2.9	weak	87.2	42.9	increase
E	23.8	11.1	2.1	weak	17.7	23.3	Slightly increase
F	25.2	25.0	1.0	weak	--	--	No change
G	25.0	2.8	8.9	bad	31.0	70.4	increase
H	35.3	166.1	0.2	strong	--	--	No change
I	46.4	96.9	0.5	good	250.4	19.0	Slightly increase
J	48.3	84.4	0.6	good	335.1	37.8	increase
K	38.2	40.2	0.9	good	76.9	20.9	Slightly increase

4.2 Changes in personnel flow and activity richness

To evaluate the vitality of space, we can analyze the number of users and the degree of space usage. In the block space, the more people flow will bring more social activities. People flow is the number of people in one space at a certain time.

From Table 3, it can be seen that the people flow of main squares have one or two small peaks in sunny days, but the pedestrian volume in the morning is less than that in the afternoon. The people flow in squares A and I show a trend of increasing, decreasing, and then increasing and decreasing again. The flow of people in square H shows a single upward and downward trend. After 11:30 and 13:30, the flow of people in A square is close to or higher than the optimal social capacity, which indicates that pedestrians are active during this period. The flow of people in H square reaches its peak at 11:30 and 15:30, but the flow of people does not reach the best capacity all day long, indicating that there are fewer people in I square. The flow of people in I square reaches the largest volume after 11:30 and 13:30, indicating that the space is fully used with good activity level.

Table 3. Flow rates in main squares at different time

	9:30	10:30	11:30	12:30	13:30	14:30	15:30	16:30	Area (m^2)	optimum capacity (people)
A	20	33	47	28	58	80	78	74	1101.8	46
H	17	25	35	50	71	76	80	72	2827.0	116
I	31	47	55	37	51	54	62	55	1315.5	54

4.3 Residence time and spatial attraction

The distribution of pedestrians' residence time reflects the spatial attractiveness. The main squares of A, H and I of Taikoo Li block are divided into units with the size of 12 m*12 m. The residence time of pedestrians in the three squares is studied at the same period of a sunny day (Table 4, Table 5, Table 6); the distribution maps are drawn accordingly (Figure 2, Figure 3, Figure 4).

Table 4. Residence time of pedestrians from 9:30 to 16:30 in square A in a sunny day

No.	Number of stay in 8h	Mean residence time (sec)	Total of mean residence time in 8h (min)	No.	Number of stay in 8h	Mean residence time (sec)	Total of mean residence time in 8h (min)
1	16	7	1.87	7	9	7	1.05
2	26	9	3.90	8	13	8	1.73
3	53	16	14.13	9	62	24	24.80
4	31	8	4.13	10	16	8	2.13
5	13	7	1.52	11	21	12	4.20
6	6	8	0.80	12	11	7	1.28

Table 5. Residence time of pedestrians from 9:30 to 16:30 in square H in a sunny day

No.	Number of stay in 8h	Mean residence time (sec)	Total of mean residence time in 8h (min)	No.	Number of stay in 8h	Mean residence time (sec)	Total of mean residence time in 8h (min)
1	9	8	1.20	9	16	650	173.00
2	42	12	8.40	10	10	8	0.13
3	51	14	11.90	11	9	7	1.05
4	13	7	1.52	12	14	700	163.00
5	26	700	303.00	13	28	600	280.00
6	12	8	1.60	14	23	10	3.83
7	7	7	0.82	15	63	20	21.00
8	24	650	260.00	16	24	12	4.80

Table 6. Residence time of pedestrians from 9:30 to 16:30 in square I in a sunny day

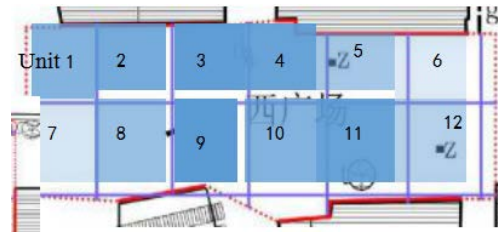| No.	Number of stay in 8h	Mean residence time (sec)	Total of mean residence time in 8h (min)	No.	Number of stay in 8h	Mean residence time (sec)	Total of mean residence time in 8h (min)
1	72	8	9.60	7	8	8	1.06
2	13	6	1.30	8	16	7	1.86
3	17	8	2.27	9	21	8	2.80
4	21	7	2.45	10	24	65	26.00
5	28	8	3.73	11	16	8	2.13
6	34	85	48.17	12	9	6	0.90

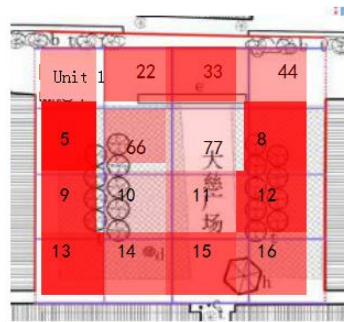Figure 2. Residence Time Distribution of Square A

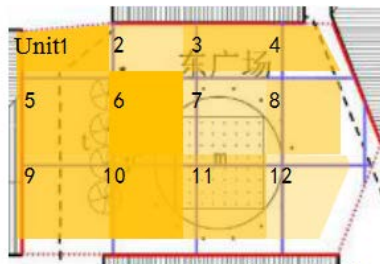Figure 3. Residence Time Distribution of Square H

Figure 4. Residence Time Distribution of Square I

The darker the color is, the more residence behaviors and the longer total residence time occur in this region within the 8 hours of a day.

Through experiments, it is found that areas where pedestrians like to stop are places with rational spatial form and rich distribution of landscape facilities. In the node spaces dominated by streets, people like to stay in the area with a lot of landscape facilities. In the square spaces surrounded by buildings, people like to stay in the edge areas of spaces. Landscape nodes in the center or scattered in other areas can attract people in the boundary to move and stay at the landscape node.

4.4 Landscape facilities and comfort level of activities

Landscape facilities are public service facilities which can meet visitors' ornamental or walking demands. These facilities include benches, railings, lighting facilities and so on. Besides providing services for visitors, they also have the function of guiding or restricting visitors' behaviors and beautifying the space.

Therefore, the distribution density of landscape facilities in the main node space of Taikoo Li block is studied (Table 7).

Table 7. Statistics of the distribution density of landscape facilities

node	landscape facilities				total	Space area (m^2)	density of distribution $(number/m^2)$
	Soft material	number	Hard materials	Number			
A	tree	1	Signage, landscape pillar, sculpture	4	5	1101.80	0.0045
B	tree	2	bench	4	6	530.88	0.0113
C	tree	1	bench	2	3	621.12	0.0048
G	--	--	Windmill, landscape pillar, Signage, bench	4	4	44.02	0.0909
H	tree	22	Ziku Tower, sculpture, Screen Wall	3	25	2826.98	0.0088
I	tree	4	Fountain, bench	5	9	1315.53	0.0068
K	--	--	Sculpture, bench, landscape pillar	5	5	367.70	0.0136

It can be seen from the table that the natural spaces in Taikoo Li block are insufficient and the distribution of soft landscape elements is on the low side. In the distribution of landscape facilities, G space is composed of road intersections. The space is small and has highest density of landscape facility distribution. A, C, H and I squares are large and have concentrated human activities. The low density of landscape facility distribution cannot meet the needs of the crowd to a certain extent. B and K squares have appropriate sizes, with landscape facilities located in the center. The focus is centralized; benches are arranged for visitors to enjoy. The density of landscape facilities is suitable.

5. Conclusions

Through the research, it is found that there are abundant spatial scales in the nodes in Taikoo Li block, and rich virtual and real changes in the boundary of nodes. The formation of grey space and the configuration of the landscape facilities in the block enrich experiences and the senses of territory. A (the West Square), H (the Daci Square) and I (the East Square) have two peaks in the flow of people within 8 hours of a day (9:30-14:30). The peaks are 11:30 and 14:30. Pedestrians prefer to stay in areas with rich landscape elements in the square, which indicates that the main node spaces in Taikoo Li can meet the needs of different people and can realize the humanized design.

Acknowledgement

References

[1] A. Nobuyoshi, External Space Design, China Architecture & Building Press, Beijing.