THE IMPACT OF UNGATED COMMUNITY CONSTRUCTION ON THE TRAFFIC NETWORK IN URBAN CHINA

Chenchen Jia, College of Architecture and Urban Planning, Tongji University, China

Yong He, Associate Professor of College of Architecture and Urban Planning, Tongji University, China

Dixin Zhang, College of Architecture and Urban Planning, Tongji University, China

Weiran Wang, College of Architecture and Urban Planning, Tongji University, China

ABSTRACT

Ungated and gated compound are the two mode of community in China. The block system, made the internal roads public, has been promoted in newly built community in order to promote the economical use of land and solve the problem of the traffic road network. However, the construction and promotion of ungated residential compounds is currently difficult, and newly built settlements are still mainly gated. To study the impact of the construction of ungated community on urban traffic network, I chose three ungated communities as cases, including Jianwai SOHO in Beijing, Chuangzhi Fang in Shanghai, and Wuhantiandi Yujiang Yuan in Wuhan, Hubei Province. Introducing the theory and method of spatial syntax and apply axial analysis to analyze the degree of integration. The syntactic analysis shows a traffic view of the constructed ungated communities. They are beneficial to the integrity of the neighborhoods and main roads as the results showed, but there are still other aspects need to be considered for the space impact of ungated residential compounds. Keywords: ungated community; spatial syntax; urban traffic network

INTRODUCTION

In China, a great deal of researches on ungated communities had been conducted in the last decade. At the planning level, it has been suggested that planning strategies for neighborhoods should follow the principles of openness, systematization and land suitability (Wei Z., et.al. 2016). At the design level, the openness of the neighborhood design strategy can be seen in the accessibility of the road system, the interaction of landscape spaces, the sharing of services and facilities, and the basic living units (Yuhang S. 2015). Pedestrian space is a key issue in the construction of ungated spaces, a street system with a reasonable pedestrian scale should be planned for the development of ungated communities (Tongyu S. 2016). A post-use assessment study was conducted for the completed Shanghai Chuangzhi Fang residential public space (Jinmi H., et.al. 2019).

Chinese researches on urban spatial form have also made extensive use of the spatial syntactic approach. Spatial syntax can be used to analyze urban spatial form. The spatial accessibility is the key factor to measure the morphology, which can be shown by the degree of integration in the syntax (Jiang L., et.al. 2003). Some scholars have used this method to study the traffic network characteristics of Wuhu City, Anhui Province (Mingxing S., et.al. 2005). Some scholars have analyzed the urban morphology of Xiamen and the results of two master plans in order to summarize the characteristics of urban morphological development (Zizhang H., et.al. 2007).

BACKGROUND

With the improvement of living standards, the number of private vehicles continues to grow. In February 2016, regarding that the Several Opinions on Further Strengthening the Administration of Urban Planning and Construction, issued by the Central Committee of the Communist Party of China and the State Council, emphasizes that "promote the system of blocks in new residential area; in principle, no more gated community should be built up", the purpose of the document is to alleviate urban problems such as traffic congestion in the vicinity of enclosed housing estates.

METHODOLOGY

This paper discusses the impact of the urban transportation and urban form before and after the construction of ungated communities. Three typical cases in China's downtown areas were selected, namely, Jianwai SOHO in Beijing, Chuangzhi Fang in Shanghai, and Wuhan Tiandi Yujiang Yuan.

These cases share belowing similar characteristics: 1) They are ungated communities and built after 2000. 2) They are located in the urban center areas. The road development has a more obvious influence on the neighborhood space. 3) They have the similar rebuilding context. The pre-construction sites had old buildings and were dominated by industrial plant-type buildings. (Figure 1, Figure 2)

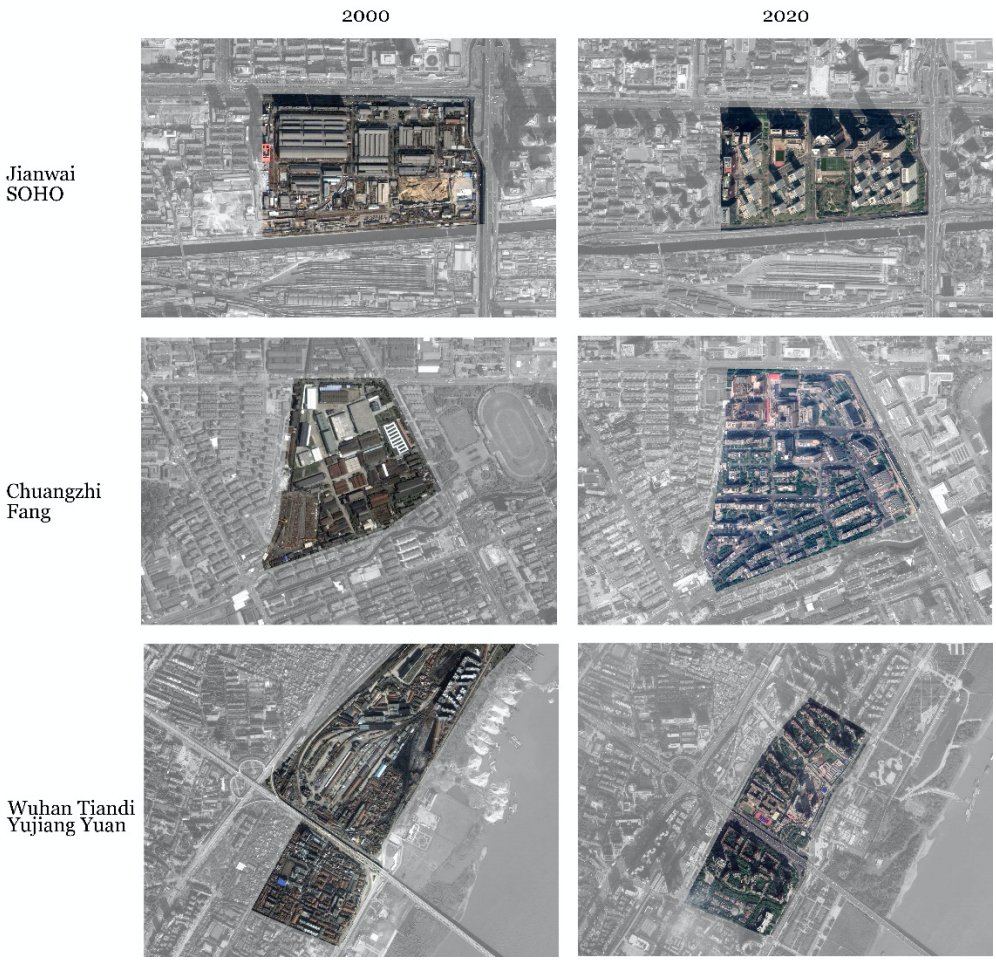

Figure 1 Site in 2000 compared with 2020. Google Satellite Maps.

	Project Name	Site	Architects	Year	Land Area	Area	FAR
1	Jianwai SOHO	Beijing	Riken Yamamoto (Japan)	2003	169,000m²	700,000m²	4.14
2	Chuangzhi Fang	Shanghai	SOM	2012	450,000m²	590,000m²	1.31
3	Wuhan Tiandi Yujiang Yuan	Wuhan	SOM	2011	612,000m²	1450,000m²	3.08

Figure 2 This is a table that lists the basic information of the three projects

Jianwai SOHO is located in the core area of the CBD on Dongsanhuan Middle Road in Chaoyang District. The functional plan of the project involves 2 office buildings, 18 apartment buildings, 4 small office buildings, shops, central garden, facility kindergarten and clubhouse. There are a large number of hotels, offices and commercial buildings around the site. To the north, the Yintai World Trade Center, Central Plaza, CCTV and Beijing TV station greatly enhance the commercial value of Jianwai SOHO area. The site is surrounded by two easily accessible subway lines 1 and 10, and a large number of bus lines also run through the site. The Tonghui River and the riverfront greenbelt plan on the south side of the site forms a good landscape feature. It is a multifunctional complex building space in the context of a well-functioning urban center hinterland.

Shanghai Chuangzhi Fang is located in the heart of the Wujiaochang, sub-centre of Shanghai's Yangpu District. It is surrounded by a great deal of commercial buildings, including Wanda Plaza, Bailian Festival Walk, Paris Spring and other large shopping malls, as well as a huge number of China's Higher education institutions such as Fudan University, Tongji University, Shanghai University of Finance and Economics, etc. Chuangzhi Fang was a joint venture invested and designed by Yangpu District Government and Shui On Land, and developed into the concept of dense road network and small neighborhoods. Chuangzhi District is divided into four parts: Chuangzhi Science Park, Chuangzhi Fang, Chuangzhi Plaza and Jiangwan Sports Center. The main area of Chuangzhi Fang is a residential area with office, commercial and entertainment facilities.

Wuhan Tiandi is located in the heart of Hankou, Wuhan Province. And it is adjacent to the The Second Yangtze River Bridge to the north, the Yangtze River to the east, and the Jiefang Park to the west. The area is steeped in history and the redevelopment of Wuhan Tiandi's historic buildings was flanked by Benjamin Wood. It consists of residential, office, hotel, retail and entertainment facilities, and The Yujiang Yuan is the residential portion of Wuhan Tiandi.

The primary data for this study came from spatial syntax. Maps of the three regions were exported via the web-based satellite map resources, exported both 2000 and 2020 version. Take the case location as the starting point and radiate 15 minutes of vehicle distance as the research scope. Using AutoCAD software and creating the axial models of the area where traffic can pass (at least two lanes in both directions). After that, they were imported into Depthmap 1.0, and conducted the analysis of Connectivity, Integration [HH], Integration [HH] R5 and Synergy.

The spatial syntactic variables covered in this paper including Connectivity C_i、Control $Ctrl_i$、Integration RA_i and Intelligibility.

1、 Connectivity: Using C_i to denote the degree of connectivity at point i.

$$C_i = k$$

k denotes the number of nodes directly connected to the i node.

2、Control values $Ctrl_i$: Indicating the degree of control a space has over the space it intersects.

$$Ctrl_i = \sum_{j=1}^{k} \frac{1}{C_j}$$

3、Mean Depth MD_i: The average of the sum of the shortest distances from a node to all other nodes.

$$MD_i = \sum_{j=1}^{n} d_{ij} / (n-1)$$

d_{ij} indicates the shortest path from node i to node j, $\sum_{j=1}^{n} d_{ij}$ indicates the total depth in the area.

4、Integration RA_i:

$$RA_i = \frac{2(MD_i - 1)}{n-2}$$

n is the number of total axes or total nodes in the urban system

5、Intelligibility: Intelligent values express the interrelationship between local spaces and whole systems.

$$R^2 = \frac{[\sum (C_i - \bar{C})\,(I_i - \bar{I})]^2}{\sum (C_i - \bar{C})^2 \sum (I_i - \bar{I})^2}$$

$\bar{C}$ is the mean value of all cell space connectivity values, $\bar{I}$ is the mean value of the spatial integration of all cells.

FINDINGS

Figure 3 Integration [HH] Analyses of Jianwai SOHO、Chuangzhi Fang and Wuhan Tiandi Yujiang Yuan in 2000 and 2020

The three cities have different developments of the road and the plan. The road planning in Beijing follows the urban planning pattern developed in the Ming and Qing dynasties. And in Shanghai Chuangzhi Fang, the avenues are developed on the basis of five radial arterial roads. At the intersection of which is the mall habitat named Wujiaochang. The road planning of Wuhan Tiandi is a combination of historical planning and geographical constraints, the characteristic of the small dense road network as well as the development along the Yangtze River.

	Jianwai SOHO		*Chuangzhi Fang*		*Wuhan Tiandi Yujiang Yuan*	
Period	*2000*	*2020*	*2000*	*2020*	*2000*	*2020*
Axis number	*321*	*553*	*248*	*456*	*213*	*314*
Integration [HH] Average	*1.636*	*1.661*	*1.125*	*1.028*	*1.095*	*1.145*
Integration [HH] R5 Average	*1.755*	*1.798*	*1.396*	*1.354*	*1.345*	*1.384*
Synergy (R^2)	*0.983*	*0.964*	*0.887*	*0.903*	*0.846*	*0.896*

Figure 4 This is a table that summarizes the data related to the syntactic analysis

In comparison with the axis number, the number of roads planned for 2020 has increased significantly compared to 2000. Due to economic and regional constraints, the speed of provincial capital cities development also differs. In Beijing and Shanghai, the volume of basic road construction is significantly higher than in Wuhan.

Integration analysis:

Global integration is one of the important variables used in spatial syntactic theory to quantitatively describe spatial organization and structure. It expresses the degree to which a spatial unit is closely connected to other unit elements. Global integration measures the potential of a space to attract reachable traffic, with warmer axis colors indicating the higher values of spatial integration, and the better reachability. Based on the traffic scale, a local integration radius of R = 5 is chosen in this paper.

The mean integration values of Jianwai SOHO in Beijing are both at [1.5, 2], while Shanghai Chuangzhi Fang and Wuhan Tiandi are both at [1, 1.5], the three regions have a positive degree of spatial integration.

The road networks of Jianwai SOHO, Chuangzhi Fang and Wuhan Tiandi have been improved respectively. Based on the main road network, Beijing has planned and built a large number of road within neighborhoods, making the 2020 integration index higher than the 2000 integration indicator. The amount of road development in the Wuhan region is not as significant as in Beijing and Shanghai. However, Wuhan Tiandi ungated community plan is adjacent to a more integrated road, resulting in an increasement in the 2020 integration indicator. In spite of the construction of ungated community spaces in the Shanghai Chuangzhi Fang area, the roads which are limited by the large campus and green spaces that cannot be ungated, and plus the expansion of the city's roads to the outside, reduce the overall density of the area.

Synergy analysis:

Synergy is used to describe the degree of connectivity between the local integration and the global integration, reflecting the connectivity between local space and selected areas. When $R^2 \leq 0.5$, the

horizontal and vertical axes are uncorrelated; when $0.5 < R^2 \leq 1$, the horizontal and vertical axes have a correlation; when $R^2 > 0.7$, there was a significant correlation between the horizontal and vertical axes (Mingxing S., et.al. 2005). The high degree of synergy between the three regions in the two periods indicates that the overall development of the city center is well.

The integration analysis of the Year 2000 shows that all three cases are in high accessibility locations. Although the sites were low-rise, high-density industrial plant type buildings in 2000, the accessibility of the area gives it a good potential for commercial and economic development. It has also gained the attention of the government and developers over the 20 years of development. As of 2020, all three areas have been developed in commercial, residential and office functions. Based on the main road plan, the road network within the neighborhoods has been refined, and in turn the accessibility of the main road has also been improved.

DISCUSSIONS

The construction of ungated communities provides the city with a number of alternative paths, and also enhances connections with other existing roads. However, the impact on the urban traffic is not very significant. The city is characterized by an overall gradual development. The construction of ungated settlements has led to a significant increase in road accessibility within neighborhoods and to a more positive degree of connectivity with their main roads. However, the construction of ungated neighborhoods in just one city block hasn't had a significant impact on urban form. The overall urban traffic is affected by many other reasons. The outward expansion of the city may lead integration value lower than before, and the deepening of roads within other neighborhoods cannot improve the reachability around selected ungated communities. Besides, matching the software results with research statistics on real-life driving conditions in the ungated community were poorly considered by this essay.

The choice of location is very important for the development of ungated mixed-mode settlements. The three ungated settlements selected in this paper have achieved outstanding results in terms of urban spatial morphology, economic development and new living space patterns. One common factor is that they all chose areas with high transportation integration and accessibility. The existing flow of people around the site provides a favorable crowd base for commercial, office, and residential space in the ungated plan neighborhood. These factors allow for effective business development in ungated plan residential areas.

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CORRESPONDING AUTHOR

Yong He, Associate Professor of College of Architecture and Urban Planning, Tongji University, 1239 Siping Road, Shanghai, 200092, China. heyong@tongji.edu.cn