



## Article

# Food Delivery Couriers and Their Interaction with Urban Public Space: A Case Study of a Typical “Takeaway Community” in the Wuhan Optics Valley Area

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**Abstract:** Food delivery couriers are a new type of worker created in modern cities within the background of a sharing economy. As a form of gig worker, they shuttle through the streets and take charge of order distribution for digital labor platforms. Food delivery couriers use the atriums and streets of their community neighborhood as their places of work and rest, occupying the public spaces that belonged to the original residents. Additionally, this phenomenon sets off a chain reaction which not only creates conflicts with the activities and passage of residents, creating time–space interlinkages, but also exerts profound influence on the economic and population structure of the region. This study focuses on the time–space patterns of food delivery couriers in the Optics Valley youth city community in Wuhan city. Inspired by Tim Cresswell’s mobility theory, this study creates a conceptual framework to explain the time–space patterns of food delivery couriers, including the following aspects: motivation, experience, conduction, and efficiency. This study revealed the characteristics of food delivery couriers on the occupation level, the conflicts between food delivery couriers and other parties as invaders of public space, and their tactics. This study also makes some policy recommendations regarding the career status of couriers and provides a reference for research on the emergence of gig workers in the urban environment.

**Keywords:** food delivery courier; space-time behavior; urban public space; mobility; gig work



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## 1. Introduction

China’s Internet economy has developed greatly since 2015. The State Council proposed actively promoting the development of “Internet plus” in its Government Work Report [1]. The development of the Internet economy has spawned a series of new industries using the gig economy as the business model, among which food delivery is a major player. After 2013, it entered a period of rapid expansion [2] and became a new labor-intensive industry [3]. In 2017, the number of registered food delivery couriers in China exceeded 7 million [4], and the market size exceeded 600 billion yuan in 2020 [5]. These couriers are representative of the gig workers created by the new economic model and can be seen as a new form of street vendor operating on a large scale.

With the normalization of population migration, mobile populations such as food delivery couriers have brought great convenience to our daily lives. They travel through the streets and alleys of cities to deliver meals, acting as a link between the scattered consumers and restaurants in cities and meeting the new needs of people’s lives. The rapid expansion of food delivery couriers has created a number of development and management issues. The problems associated with food delivery couriers have drawn a great deal of attention in existing research, but more attention has been focused on the profession itself, with

studies conducted from the perspectives of economics, management, and sociology. The current research focuses on delivery mode [6], salary system [7], labor rights [8], interest protection [9], big data, and intelligent processes [10]. This is because the current problems about food delivery couriers are more related to these disciplines.

However, at the same time, we often neglect the urban environment in which the food delivery couriers work. These couriers “invade” the urban public space, which has been formed in a fixed order, gathering in the marketplaces, streets, and neighborhoods of the city; competing for public space with the original residents; and generating new spatial phenomena. If the city management department ignores this aspect, the impact on the urban space created by food delivery couriers will be underestimated and we will probably fail to update our strategies for the development of cities.

Our study focuses on the relationship between food delivery couriers and urban public space, are their behaviors influenced by urban public space, and are they reshaping it? That is, whether such a two-way influence relationship exists and in what way is our main question in this study. Additionally, we also hope to explore whether they have corresponding urban space rights and how city management departments should treat them.

## 2. Literature Review

### 2.1. Gig Economy and Gig Workers

The gig economy refers to workers who operate under flexible arrangements, only completing a particular task or working for a defined period of time [11]. With the growth of online platforms, gig work has become a global phenomenon [12] and captured public and policy interest [13]. At present, relevant studies can be divided into three aspects. The first is the condition of gig workers. Many studies have found that gig workers experience problems such as difficulties in guaranteeing their contractual rights and interests [14], high mobility with low stability [15], and uncertain working hours [16]. The second theme concerns the impact of the gig work. Flexible employment has broken the stereotype of work [17]. The third theme concerns the technology used in gig work, with researchers focusing on the proper use of tools such as social media [18] and algorithms [19].

Food delivery couriers are typical gig workers that thrive on digital platforms [12]. They usually come in two forms: full-time, being strictly regulated by the platform, and crowdsourced, being more flexible and considered “self-employed” [12].

### 2.2. Workforce’s Interaction with Urban Public Space

Space is at “the very heart of social theory” [20]. Foucault [21] analyzes “disciplinary space” and suggests that “[s]pace is fundamental in any exercise of power”. Castells [22] states that “space is not a ‘reflection of society’, it is society”. Regarding the relationship between labor and space, Thompson and Smith [23] state that there is a “need to introduce the dynamics of space and time into the study of labor process theory”. Labor is never spaceless; the workspace is an intentionally created object and therefore an instrument of managerial control and resistance. For gig workers such as street vendors and food delivery couriers in the city, the social processes resulting from digitization have not been disconnected from space, but rather have entered a closer relationship [24].

More specifically, the spaces that are closely linked to casual workers are urban public spaces. Urban public space has two important functions: the first of these is political, with citizens freely expressing their ideas and opinions [25]. The second concerns sociology and urban planning, where public space plays an important role in social interaction and makes urban life healthier [26]. People can establish their own identity through repeated spatial practices [27], and urban public spaces are places where gig workers in the city construct their sense of identity and daily life. This is the sociological function of urban public spaces for gig workers.

For gig workers in cities such as street vendors and food delivery couriers, public spaces are the places where they work on a daily basis. They interact with the public space

and develop their own tactics. Scholars are interested in this interaction between workers and the public space. Due to the long history of street vending, street vendors are the most typical subjects of this research. Street vendors bring us convenience and construct a special view in our city, but at the same time, they are also seen as “invaders” of urban public spaces, and many local governments consider street vendors to be disruptive to the view and order of the city, driving them away and excluding them [28]. Due to the highly mobile nature of street vendors’ work and the need to struggle with their managers, their relationship with the public space is constantly changing, with a “dynamic balance” being maintained. On the one hand, the daily work of street vendors is influenced by the public space of the city. The flow of customers in a certain area influences their choice of workplace [29]. The city managers’ control over zones and periods also affects their daily work [30]. On the other hand, the behavior of street vendors can also have an impact on urban public spaces. They occupy space based on the principle of balance between efficiency and regulation. Additionally, they can form new, flexible spatial boundaries based on the long-term coordination with various users of the public space [31]. They can also rely on their vending tools to make rapid spatial transformations or reach agreements with fixed vendors to form shared spaces [32]. In summary, the state of street vendors in urban spaces can be described as the collective result of the power, influence, resources, and resolve of property owners [33] as well as the tactics used by street vendors.

As it stands, labor processes and spaces remain two variables that are interdependent but usually analyzed separately. The science of labor is not closely linked to the science of space [34]. Food delivery couriers can be seen as a new kind of “street vendor” in a gig economy, generating a new relationship with public space and creating their own tactics. In this study, we hope to combine the perspectives of labor and spatial sciences and focus on the interaction between food delivery couriers and urban public spaces.

### *2.3. Food Delivery Couriers’ Behavior*

The work of food delivery couriers may seem very free in terms of time and space, but they are actually subject to strict regulations by the platform, including requirements for their working hours, work content, and work quality. The platform will designate work areas for couriers according to the size of the city, which creates a fixed, flexible, and non-transparent space [24]. The couriers do not know the specific spatial boundaries or working spaces of other couriers, creating great limitations when they are choosing their work. In addition, takeaway platforms have strict limits on the completion time of each order, and couriers who deliver overtime face penalties [35].

With such strict regulations, couriers have also created their own tactics. On the individual level, delivery couriers often break traffic rules in order to deliver their orders on time. Their main violations include running red lights, driving on the motorway, and driving in the opposite direction [36], which has led to a high volume of traffic accidents being associated with delivery couriers. Many researchers have suggested that the relevant legal system needs to be improved [37]. On the group level, the lack of co-location of the delivery labor process makes it difficult to hear workers’ voices because they are so spatially separated [38].

The existing studies on this topic have mainly focused on the delivery process of couriers in cities [24]. However, relatively little research has been conducted on the “workplace” in which couriers congregate in cities. This gap in research led us to overlook the impact of the mass “invasion” of couriers on the public spaces of neighborhoods, markets, and squares in cities.

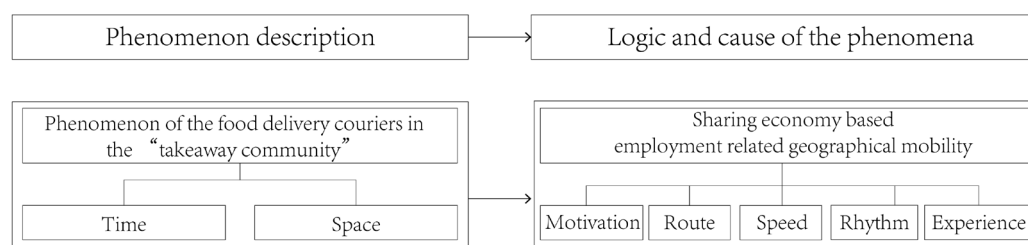
### *2.4. Research Gap and Study Design*

It is necessary to study the mobility of gig workers in the urban public space from the perspective of the urban space and urban management. While the current research on food delivery couriers is mainly focused on their process of their movement in the city, this

study hopes to focus on the public spaces where couriers gather in our city and study their interaction with the urban public space.

Food delivery couriers are new gig workers creating in this Internet era. They are a modern embodiment of the old profession of street vendors, and their work is an integral part of the functioning of modern cities. While participating in urban life, they also participate in the use and construction of urban public spaces. A dynamic balance can be reached in the process of urban development. This is a sustainable topic that is worth studying.

This study focused on Wuhan Optics Valley youth city community, a specific and typical case, to study the behavioral characteristics of its work in both time and space, and to pay attention to the changes brought to the urban public space by the “invasion” of the courier. This paper analyzed the causes of such spatiotemporal phenomena with the workforce mobility model, based on the original mobility model, we constructed SE-E-RGM (Sharing economy-based employment-related geographical mobility model) as the analytical framework. The model consisted of five elements: motivation, route, speed, rhythm and experience. In the end, we proposed some policy suggestions for urban space construction and management based on this research (Figure 1).

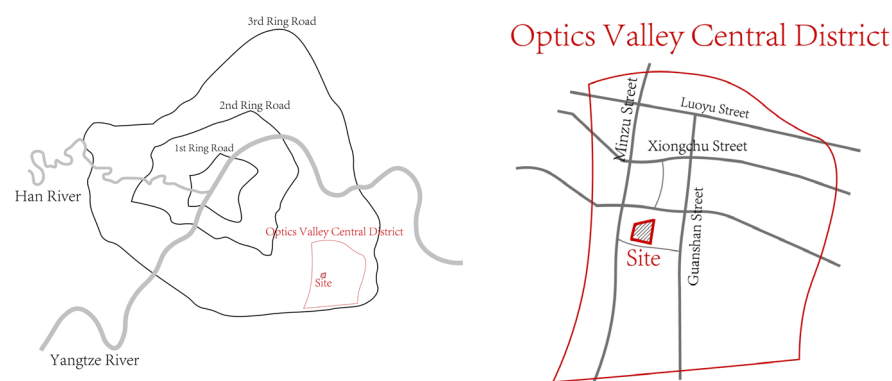


**Figure 1.** The analytical framework.

### 3. Study Area and Methods

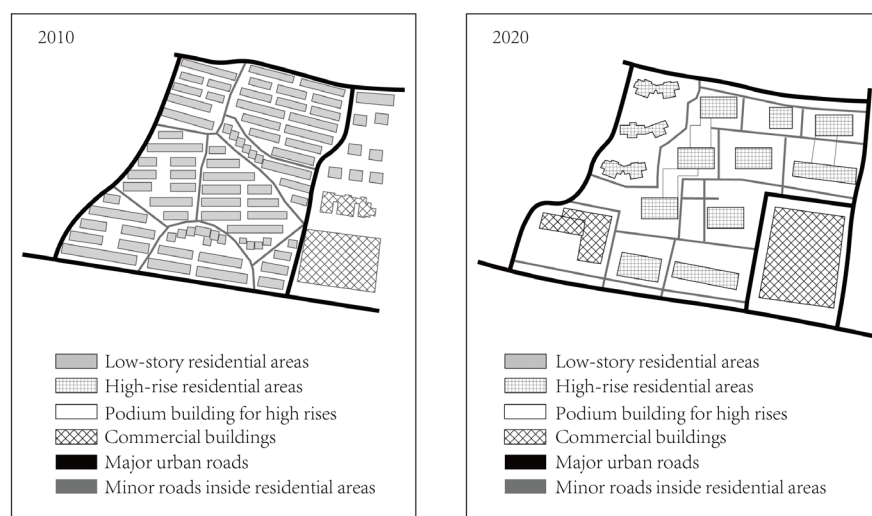
#### 3.1. Study Area

The “takeaway community” phenomenon in Wuhan is expressed well by the Optics Valley youth city community, which has a high density of young residents and a booming takeaway business industry. Optics Valley youth city, where the takeaway community is located, is situated in Optics Valley Central District, east of Wuhan city. This community lies in the center of Optics Valley Central District, adjacent to two main city streets: Minzu Street and Guanshan Street (Figure 2). Optics Valley Central District was not developed until its development was proposed between 1995 and 2000. During the initial development planning, it was the site of several low-rise residential areas. However, as Optics Valley Central District grew ever larger, people began to gather in this newly developed region, and the FAR on the site was forced to rise. Therefore, in 2013 all the low-rise residential buildings were demolished and a new community of high-rise residential buildings took their place, which was how Optics Valley youth city emerged (Figures 3 and 4).

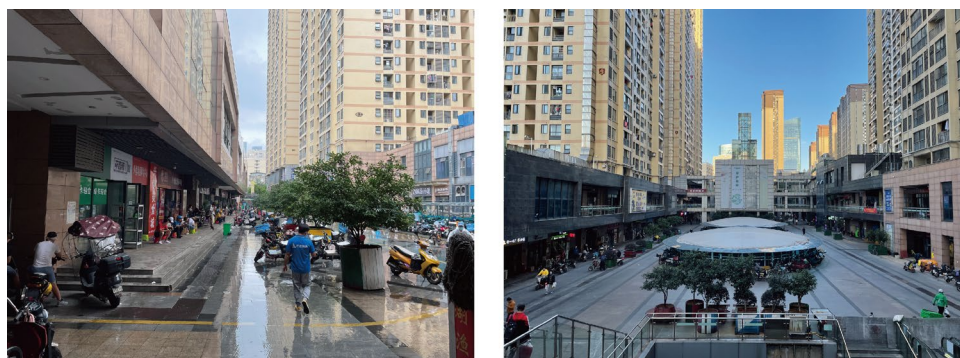


**Figure 2.** Location of the Optics Valley youth city community.





**Figure 3.** The change of the Optics Valley youth city community.



**Figure 4.** Photos of the Optics Valley youth city community.

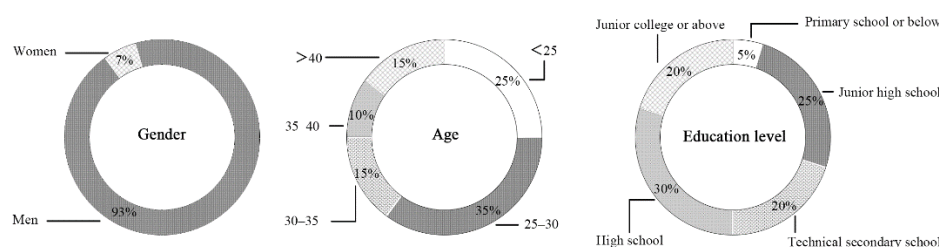
We chose the Optics Valley youth city community as our research site for several reasons. First of all, from the perspective of the city, the Optics Valley area is a new urban area that has developed rapidly in Wuhan in the last 20 years. Some new urban problems and spatial conflicts that have occurred in the recent 20 years are concentrated in this area such as traffic congestion and poor quality of public space [39]. So using this area as our research object is representative in terms of both time and space. Secondly, eight universities, two scientific research institutes, and a large number of internet enterprises are clustered in the Optics Valley area, and seventy percent residents of this area are under the age of 37 [40], providing a very large population of consumers and practitioners in the takeaway (internet catering) industry. Therefore, from the perspective of industry and population, the Optics Valley area is unique. Thirdly, after carrying out a pre-research in the Optics Valley area before undertaking the main research, we concluded that the Optics Valley youth city community has a high density of takeaway restaurants. The total building area of this community is 209,500 m<sup>2</sup> and the plot ratio is over 5.0. There are 8358 dwelling units in this community. And more than 60 takeaway restaurants are concentrated in this community. We got it from the food delivery couriers and some news reports that this community has the most food delivery couriers out of anywhere in the Optics Valley area [41], therefore, the Optics Valley youth city community provided us with abundant research samples. Finally, the Optics Valley youth city community has a high plot ratio, large resident population, and complex population composition, and there is limited public space inside the community. Therefore, the relationship between the food delivery couriers and the residents in the community is complex and the conflict is significant; therefore, it can fully show the influence and change brought about by this new economic model and

occupational group after their intervention. To sum up, these are all the reasons why we chose to use the Optics Valley youth city community as our research object.

### 3.2. Study Methods

This study used Jan Gehl's PSPL (Public Space and Public Life Survey) research method [42], including an on-the-spot investigation method, interview method, map marking method, and on-site counting method, to understand the community activities and behavior characteristics of food delivery couriers in the public space, to explore the relationship between the material environment and food delivery couriers' work and life through qualitative and quantitative analyses, and to accurately reveal the public space strategy of food delivery couriers in takeaway community.

First of all, we conducted sufficient pre-survey and pre-interview in the research area, and had macroscopic observation and statistics on the basic data of the number of food delivery couriers in this area, such as gender ratio, age and education level (Figure 5). On the basis of the pre-survey, we established contact with the food delivery couriers who were willing to accept further investigation.



**Figure 5.** Basic information of food delivery couriers in the Optical Valley Youth City community.

The researchers provided their identification and conducted in-depth interviews. A questionnaire asking questions about the differences between their life and work before and after the takeaway community was established and how their life and work function in the mechanism of the takeaway community was distributed to them. For the pre-survey part, the researchers asked questions about the couriers' age, sex, home province, marriage status, and how long they had been working at their job. The researchers also asked whether they were crowdsourced couriers or special delivery couriers, based on which the researchers would ask slightly different questions in the following section. In the formal survey that followed, the researchers asked more specific questions, including: "Are you a part-time courier? How many food delivery couriers do this job part-time?", "What do you usually do in the time interval between delivery orders?", "Why do you choose to work around Optic Valley youth city? Is this choice made by will or corporation arrangement?", "Is there a team connecting you and other couriers? Do you have meetings regularly? And how often?", "How did factors like school season, the coronavirus epidemic affect your work?", and "Where do you deliver your package to most often?". The determining factors of these questions were summarized and classified for use in further analyses. We recorded and sorted out the interview content in the form of words, marked their movement track in a day on the map, and made diagram recordings of their way of using space.

In the process of pre-survey, we collect data about this community's food delivery couriers from a macro point of view. And in the process of formal investigation, we had in-depth interviews for every interviewee from the micro perspective. We through a combination of macro and micro perspectives to ensure the study is representative and universal, and guarantee the quality of this study. After collecting the data and information we need, We have carried on the further diagram and the law summary in the way of urban research to reach our research conclusion. (Table 1).

**Table 1.** Research recordings.

Time	Condition	Investigating Details
10:00–11:30, 16 November 2020	Monday, cloudy	Observation
14:00–15:30, 18 November 2020	Wednesday, sunny	Pre-investigating
15:00–17:00, 29 July 2021	Friday, cloudy	Pre-interview
15:30–17:00, 29 July 2021	Thursday, sunny	Observation and determine the research area
14:00–15:30, 11 August 2021	Wednesday, rainy	Pre-interview
14:30–16:30, 21 August 2021	Sunday, sunny	Interview
15:00–17:00, 18 September 2021	Sunday, cloudy	Observation and interview
13:00–15:00, 20 September 2021	Monday, sunny	Interview
08:30–10:00, 25 September 2021	Sunday, sunny	Measure and draw the plan

#### 4. Phenomenon of the Food Delivery Couriers in the “Takeaway Community”

As described above, the Optics Valley youth city community is a typical workplace for food delivery couriers and is regarded as a “takeaway community”. Couriers in this area form their own order. We conducted our research in this area, focusing on courier’s individual behavior patterns in a certain period of time. We describe the behavior pattern of food delivery couriers from two aspects, time and space.

##### 4.1. Time

Through our early interview and follow-up survey of the couriers as well as our survey of the working mode of takeaway restaurants, a tidal effect in their schedule was observed in this study. Lunch (11:00–14:00) and dinner (17:00–19:00) times were the peak periods. There were a huge quantity of delivery orders at that time, which meant that the delivery time of each order in the peak period was short and the takeaway community acted as a terminal for the couriers’ workflow, with the couriers not spending much time in the community.

In the morning and afternoon off-peak period, there were fewer orders and most couriers were waiting for work. The work characteristics of food delivery couriers mean that they have no fixed working space, so they would choose to rest, socialize, or take orders in the public space of the community. Therefore, in off-peak times, we saw a lot of couriers in the takeaway community gathering in the public spaces. Some couriers chose not to take orders in the morning and evening, so there were fewer couriers in the community during those two periods.

The takeaway business of the Optics Valley youth city community mainly covers customers in the Optics Valley area. Universities, scientific research institutions, and high-tech enterprises gather in the Optics Valley area. Middle-aged and young residents account for more than 70% of the population, and a large number of these are college students. At the same time, through our research, we found that the customers of takeaway meals mainly consist of college students and white-collar workers. This population structure and customer group construction lead to the takeaway industry in this area having annual off-season and peak season periods. Generally speaking, due to college holidays occurring from July to September and January to February, the number of takeaway orders in these periods decrease—thus, they are generally regarded as the off-seasons. Meanwhile, the other months are seen as peak seasons. During peak seasons, the number of takeaway orders increases significantly on days where there is extreme weather due to a decrease in customers’ willingness to venture out for a meal.

##### 4.2. Space

###### 4.2.1. Function

Before the rise of takeaway restaurants, the Optics Valley youth city community was a typical high-density residential community in the Optics Valley area. The area is composed of 13 residential towers, and the podiums at the bottom of the towers form two atriums.

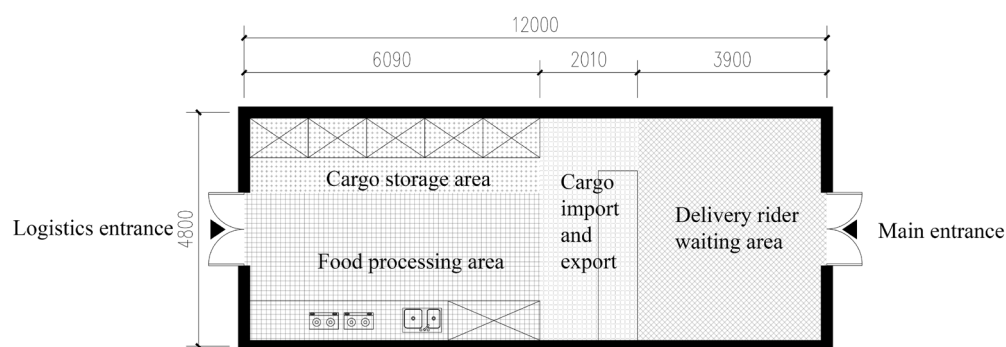
After takeaway restaurants began to enter this area, the function of public space in this community changed. Food delivery couriers were attracted to the community by the abundance of demand in the community. The Optics Valley area gradually becomes a major hub for food delivery couriers, and many food delivery couriers groups formed based on this community. As the popularity of takeaway restaurants in the Optics Valley youth city community grew considerably within a very short period, such industrial gathering can maximize the work efficiency of couriers. In our research, the two courtyards in the north became important working spaces for food delivery couriers throughout the whole delivery process, with these being used for the daily routines of food delivery couriers, such as morning meetings and waiting during off-peak periods.

The high concentration of food delivery couriers and takeaway restaurants in this area has already changed the community's commercial function and population structure; we defined this community as a new kind of community called a takeaway community.

#### 4.2.2. Space Pattern

With the development of the takeaway industry, food delivery couriers have entered this community and created new demands for the space of takeaway restaurants. Takeaway restaurants are similar to traditional takeaway restaurants, catering to both dine-in customers and food delivery couriers. Their spatial layout is consistent with that of traditional restaurants.

After the takeaway industry reached a certain degree of aggregation in this community, takeaway restaurants catering especially to food delivery couriers have begun to appear in the community. The spatial layout of this kind of restaurant is set up to benefit the working logic of couriers. As there is no dining area but only a kitchen and fetching window, this type of restaurant is far smaller than traditional restaurants in terms of spatial scale. The average width and depth of takeaway restaurants are about half that of traditional restaurants (Figure 6). In this type of restaurant, the service personnel and the food delivery couriers are completely separated, and there is basically no crossover between the kitchen area and the food fetching area. The layout of the restaurant also fully considers couriers' need to pick up food, with gray spaces being set up as temporary parking areas and the placement of prominent and clear signs (Figures 7 and 8). Some takeaway restaurants also provide seats allowing couriers to eat and rest during off-peak hours.



**Figure 6.** The plan of a typical takeaway restaurant.

#### 4.2.3. Streamlines and Accessibility

The mobile logic of food delivery couriers at work has certain characteristics. As they use electric motorcycles as their basic transportation, they have created a lot of changes in terms of spatial streamlining and traffic logic after “invading” the Optics Valley youth city community. Food delivery couriers work at a fast pace during rush hour and need to travel in and out of the community frequently, which can cause major conflicts with pedestrian traffic. At present, the entrance to the northeast corner of the community serves as the main entrance for food delivery couriers, reducing the chance of couriers having to pass through other atriums and interacting with the stream of community residents (Figure 9).



At the same time, because electric vehicles are very sensitive to the height differences and steps, in the process of the development of the takeaway industry, the height differences and steps in the two courtyards in the north of the community have also been optimized, with ramps and special channels set up for electric vehicles to improve the accessibility of takeaway restaurants. At present, food delivery couriers can drive electric bikes directly to the pickup windows of all takeaway restaurants in this community (Figure 10).

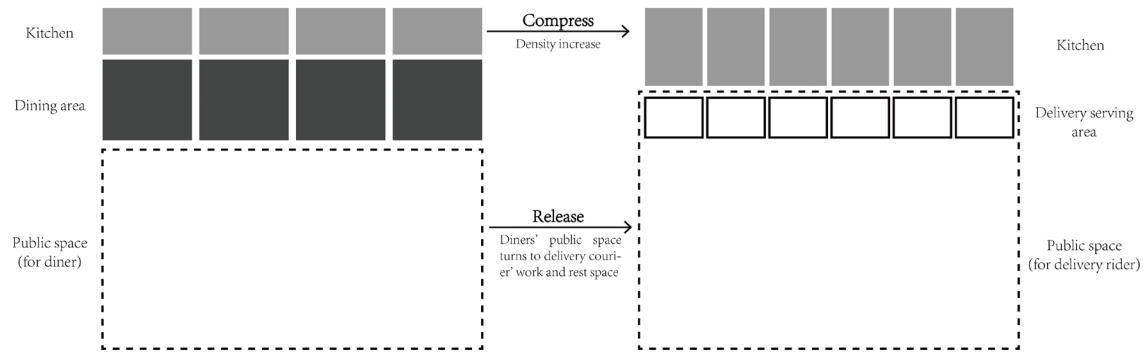


Figure 7. The phenomena of “Space Compression”.



Delivery serving area and temporary parking area in front of the restaurants



Takeaway restaurants are smaller than traditional restaurants

Figure 8. The photos of the restaurants in Optics Valley youth city community.

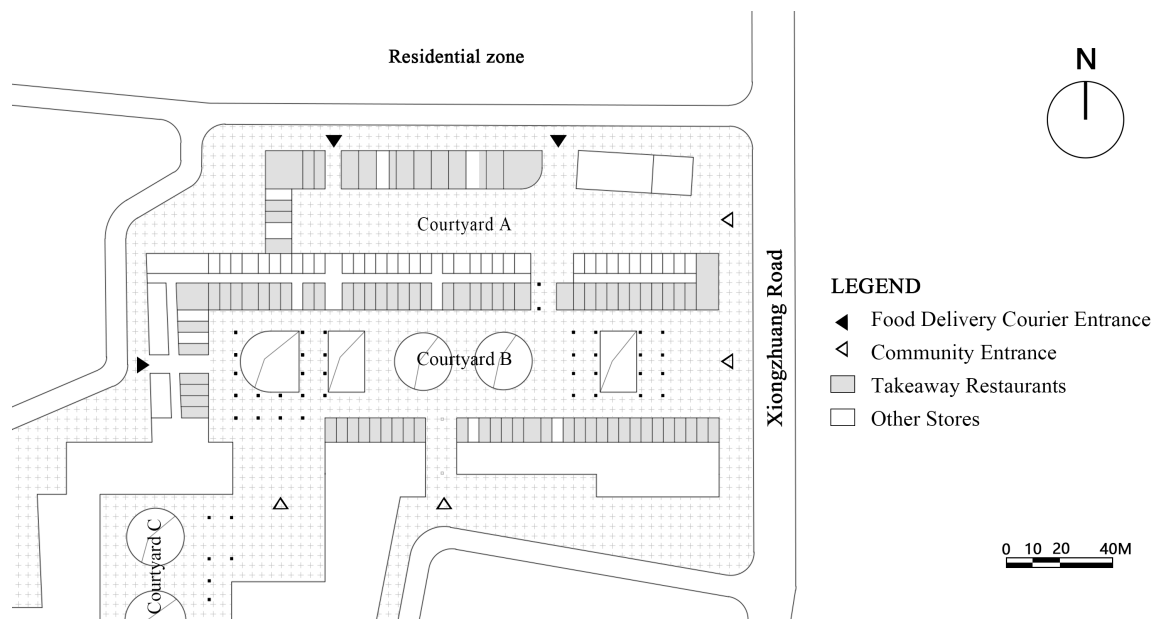
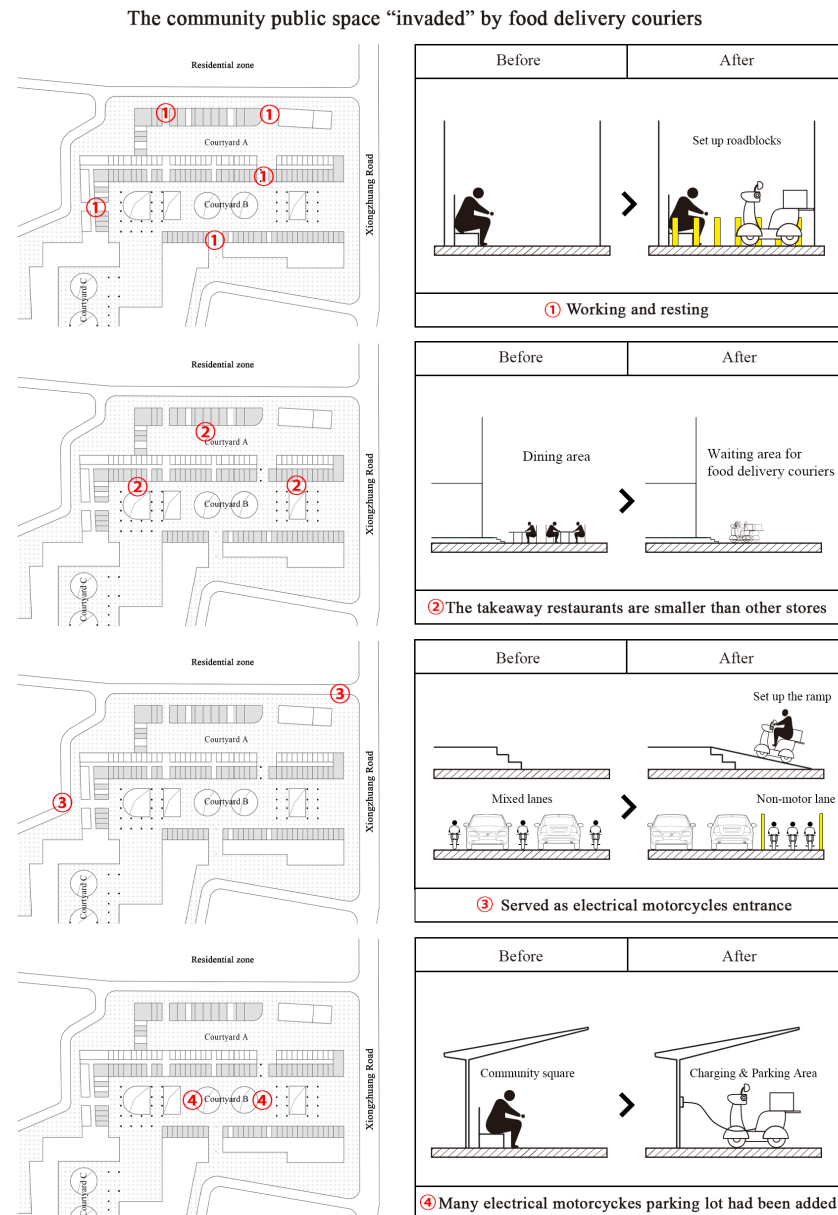


Figure 9. The plan of Optics Valley Youth City community.



**Figure 10.** The changes in community public space after the invasion by food delivery couriers.

#### 4.2.4. Equipment and Resources

Food delivery couriers use electric motorcycles for work, so there is a lot of demand for community space based on electric motorcycles, leading to the development of community public spaces. Parking is a fundamental requirement for couriers, as their electric motorcycles need to be parked in a safe and convenient place. We found in the second atrium that the oval area around the courtyard had been transformed into two groups of parking areas for electric motorcycles. Canopies had been set up too, and many couriers chose to park their electric motorcycles here. Another requirement is a space for charging. In our interviews, the couriers said that their batteries could support half a day to a day of riding when fully charged. In the early days of this industry, to meet the needs of couriers, some stores in the community and some service enterprises set up charging facilities in public spaces. Recently, we have seen more convenient shared battery cabinets popping up around the community; at these places, couriers can take a fully charged battery to replace their empty one.

We can clearly conclude that the food delivery couriers have brought changes to the function, spatial pattern, streamlines and accessibility, equipment and spatial resources of the urban public space after entering it, and we can say that they have participated in the reshaping of the public space.

## 5. Mobility of Food Delivery Couriers—Employment-Related Geographical Mobility Model Adapted for Food Delivery Couriers

With the furthering of this research, researchers strived to analyze the phenomenon observed more systematically and reveal the underlying logic behind the exterior activity patterns. Inspired by Cresswell's work [43], this study took the model "six elements of a politics of mobility" as a reference and developed a set of theories to explain couriers' mobility laws. Mobility was disintegrated into three perspectives in Cresswell's model: movement, practice, representation, respectively explaining mobility on physical, experiential, and socioeconomics levels. Subsequently, he extracted six elements to further elaborate the model. In this study, after depicting the phenomenon in the preceding part to illustrate the problem from an objective perspective, in this section the researchers used five elements to further analyze the mobility pattern of couriers. Despite the revisions of a few elements, these five elements are supposed to be used analyze the complicated relationship between mobility and space.

First, motivation refers to the inner impetus of couriers as to why they chose this job, defining the force of mobility. Then, with regarding to route, researchers studied the routes of the working couriers throughout the community and sought to make a comparison of the public space's ownership and facility status before and after the couriers set foot in the community, which depicted the influence exerted by couriers. Meanwhile, the study of rhythm reveals how couriers gather and scatter throughout a working day and how these different situations alter. Additionally, researchers focused on experience to discuss the relationship between newcomers, such as couriers and the urban context with which they are involved. Through the study of five elements, researchers set up a theoretical model based on E-RGM (employment-related geographical mobility model, Tim Cresswell [44]).

### 5.1. Motivation

The researchers asked "In which year did you come to Optics Valley youth city community and why did you choose such a career and such a place to earn a living?" to define food delivery couriers' motivation. Although there were common grounds among the answers, the couriers emphasized their different perspectives.

First, the couriers were generally attracted to the comparatively high salary status in such a profession. To be specific, given the condition that the same effort is spared, a food delivery courier's salary might be higher than that for a job performed by someone with the same level of education, say, a restaurant servant or a cleaner. One food delivery courier said [DC2] "I used to be a cook and I merely earned 5200 yuan (approximately 804 USD) a month but being a food delivery courier, I could earn over 8000 yuan (approximately 1237 USD) a month, all I need to do is to be a little more diligent and take more orders". (Table 2) As to why they choose Optics Valley youth city to start their courier career, they gave coincidentally similar answers. As the largest spot for food delivery service in Wuchang, Wuhan, the number and density of takeaway restaurants were considerably higher than in other spots, which meant that they could receive more orders to earn more. Meanwhile, the resting space and charging piles were comparatively sufficient. Additionally, as a takeaway community, Optics Valley youth city provided many couriers with a cheap price for house renting, which suited a lot of couriers' needs.

Second, being a food delivery courier required little training. With a motorcycle and a navigation app, once registered on the food delivery platform, almost anyone can start taking orders. Moreover, considering that rural-urban migrants composed a large part of the food delivery courier population, these migrants were mostly primary school graduates who did not believe they were capable of highly technical work. One food delivery courier

[DC6] said that he chose this job. He thought he could do nothing else because he was under-educated (Table 2).

**Table 2.** The information of the Interviewee.

Interviewee Code	Age	Home Province	Work Time	Work Type	Delivery Range
DC1	40	Shanxi	09:00 a.m.–09:00 p.m. 6 days/week	Crowdsourcing	5 km
DC2	24	Hubei	10:00 a.m.–10:00 p.m. 7 days/week	Crowdsourcing	5–7 km
DC3	40	Hubei	10:30 a.m.–01:00 p.m. 03:30 p.m.–05:00 p.m. 6 days/week	Special	5 km
DC4	26	Hubei	09:00 a.m.–09:00 p.m. 7 days/week	Special	3 km
DC5	28	Hubei	10:00 a.m.–09:00 p.m. 7 days/week	Half-spacial	5 km
DC6	23	Henan	10:00 a.m.–07:00 p.m. 5–6 days/week	Crowdsourcing	4–5 km
DC7	25	Yunnan	Uncertain	Crowdsourcing	4 km
DC8	30	Hubei	10:00 a.m.–08:00 p.m. 6–7 days/week	Half-special	3–5 km
DC9	27	Hubei	10:00 a.m.–05:30 p.m. 6 days/week	Half-special	5 km
DC10	33	Hubei	10:00 a.m.–12:00 p.m. 7 days/week	Crowdsourcing	≥4 km

Third, being a food delivery courier, especially a crowdsourced one, meant that he could enjoy a certain level of freedom on time arrangement. In the research, a large portion of food delivery couriers said that they had part-time jobs or study plans to attend to, and food delivery courier could serve as a transitional job for them, providing both money and flexible time arrangements.

Moreover, Optics Valley youth city became the most preferred choice for food delivery couriers for good reason.

Therefore, Optics Valley youth city became an important place for food delivery couriers in Wuhan. It was not only the benefits of the career itself that create such a phenomenon, but the success that also contributed to the unique environment of the community.

## 5.2. Route

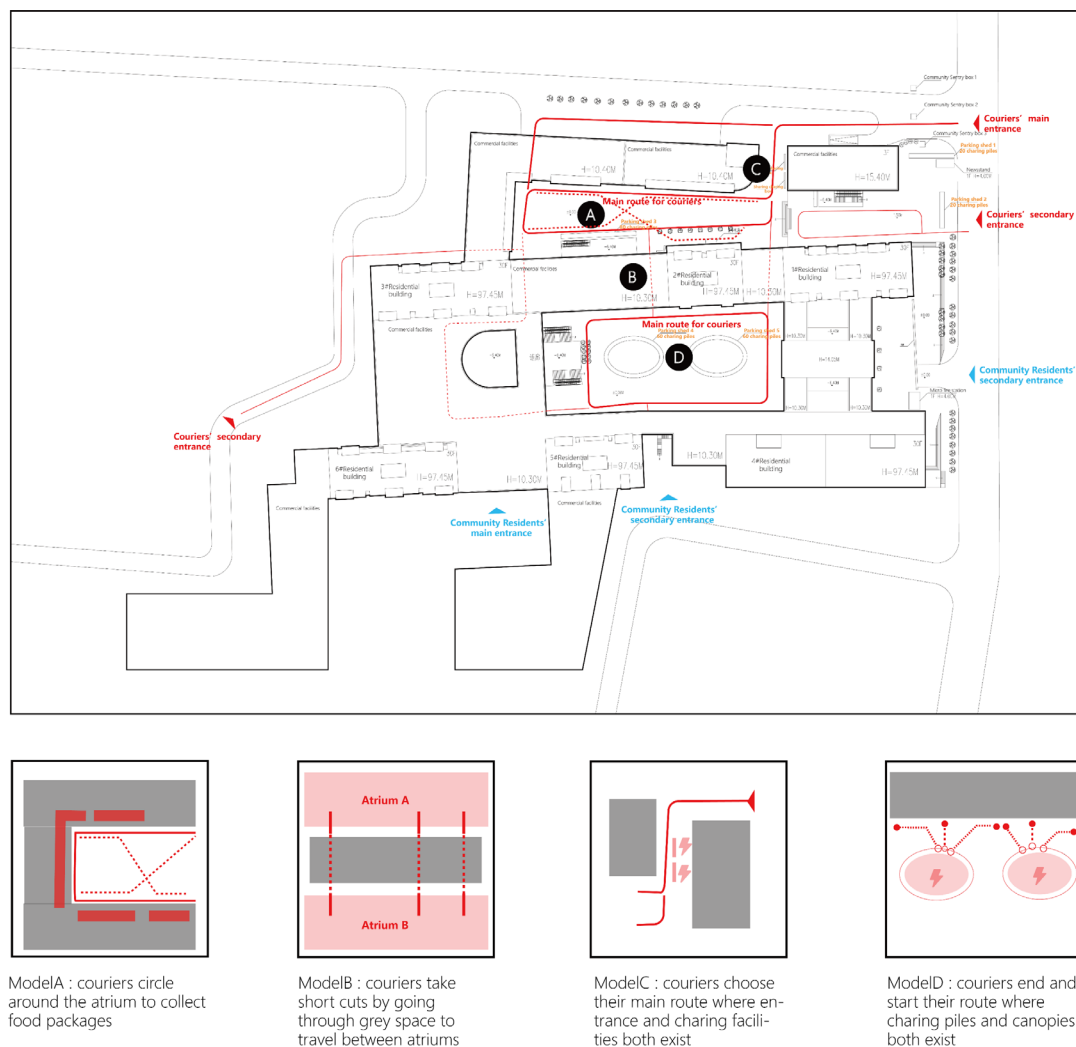
Route refers to what paths couriers choose to drive through the community on a daily routine. Researchers asked questions such as, “Which route do you usually take to pick the food package up and leave the community?”, “Which route would you take to change or charge your motorcycle battery and go back to work?”, and “Is it convenient for you to take such route in this community to get everyday’s work done?”. Such investigation revealed the changes in community public space because of the couriers’ working routes in the community.

In the investigation process, we noted that couriers’ path selection was not only influenced by the demands of work and the seek of convenience, but also the space elements in the community, like the space layout or facility distribution. Researchers mapped the major routes taken by couriers and concluded four major models of couriers choosing their route based on space elements.

The first model applied because of the distribution of takeaway restaurants and couriers’ working habits. Because takeaway restaurants array along the atrium, the couriers often had to circle around the atrium to collect all the food packages from different takeaway restaurants.

The second model originated from the layout of the community and couriers’ seek of convenience. In the process of collecting food packages, they sometimes needed to travel between atriums, therefore the “tunnels”, the grey space in between became an important part of their routes.

The third and fourth model was defined by space elements like the location of entrances and charging facilities. Because the battery usually lasted for half a day, couriers were used to charging or using sharing charging boxes at noon. Although couriers started off by power facilities, the routes where charging facilities and canopies existed indeed became their most frequently used ones (Figure 11).






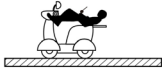


**Figure 11.** Four models of couriers choose their routes based on space elements.

### 5.3. Speed

Speed refers to how couriers change their working and resting status and the corresponding acts to transform public space to their own uses. The job as a courier means constant shifts from standby status to working status and the other way around. Researchers therefore asked couriers “What kind of strategy did you use to switch from working status to standby status? How did you make use of the time period when there was no order? Where did you stay and what did you do to pass such time?” Meanwhile, during the observation of couriers’ behavior in their comparatively free period, researchers noticed: couriers tend to act along with their motorcycles, thus forming new activity units to make use of the vicinal space, forming an unique mechanism.

The typical model was to construct a space of one’s own using a motorcycle and one’s own body. Sometimes, a group of couriers and their motorcycles form a sequence of space belonging to couriers alone. They pose different gestures to fit into the space created by motorcycles. Some food delivery couriers lay on their motorcycles and went on their cellphones to watch short videos and relax. Others sat on their motorcycles, often with their legs crossed, and lowered their head to use their cell phones. Sometimes, their motorcycles could even serve as a mobile platform to place their box lunch. Such a method was useful when couriers need to quickly switch from standby mode and working status (Figure 12).



Models	Model I : using motorcycles as a narrow bed	Model II : using motorcycles as a chair	Model III: using motorcycles as desks
Samples			
	Couriers lay on their motorcycles and put up their cellphones to watch short videos and relax	Couriers sat on their motorcycles, often leg crossed, and lowered their head to use cellphones	Sometimes motorcycles even serve as a mobile platform to place their box lunch
Form			
Explanation	Generally, this method is most frequently used in the afternoon, taking a nap after watching short videos becomes a common practice.	Food delivery couriers often take this gesture when waiting orders, as it's quite convenient to shift to work mode.	Food delivery couriers prefer simple meal to fill their stomach, and their motorcycle often serve as dining tables.

**Figure 12.** Three models of couriers full use of motorcycles to form individual resting space.

Consequently, a part of the public space in the community changed because of these acts of couriers, especially on a functional level. These areas were intended for motorcycle parking, yet they were also endowed with another meaning: this place meant the stop of working status and the mutual rest of both the courier and the motorcycle.

In a word, a notable fact was the powerful binding force between couriers and their motorcycles. In some ways, the motorcycles could count as an individual space element, controlling couriers' behavior when they change their working and resting status and the corresponding acts to transform public space to their own uses.

#### 5.4. Rhythm

The variations in the flow of people in the community are largely shaped by the daily workflows of couriers. In this research, we relied on observation and asked questions such as "When do you usually get together in a working day and what do couriers often do in these time periods?". Taking into account both the observation results and responses to questions, we discovered the features of couriers' activity patterns in public spaces over a day; the typical law was that scattering and gathering altered in periodically.

The periods of scattering were obvious; during the morning and the afternoon, when the orders have not piled up, couriers tend to scatter throughout the community space. They make use of the public facilities in the community to rest, with few intentional gatherings.

The gathering patterns, on the other hand, were different and could be categorized. In the morning, at about 10:00 a.m., couriers would get together and stand in rows to hold morning meetings. A leader of the department would give speeches regarding safety problems and performance feedback. They tended to choose the atrium or the corridor to hold such meetings because a comparatively large open space was needed and there might be a need of taking photos in preparation for inspection from takeaway platforms. However, when the busy lunch and dinner times came up, the couriers' gathering rhythm was dominated by delivery restaurants. When a delivery restaurant received too many orders or when a restaurant was too slow to make adequate numbers of food packages, couriers would gather around their doorsteps to wait for packages. At times, couriers would also get together when it was not that busy, and such gatherings were dominated by communal activities, such as playing phone games together or chatting. In such situations, the atrium corners and gray spaces under eaves were their preferred places, where there's just enough room for three or four people to sit and eaves could shield sun and rain, to a certain extent providing a sense of privacy and comfort. (Figure 13).



**Figure 13.** Three gathering patterns (morning meeting, delivery waiting and leisure).

### 5.5. Experience

The major public spaces in Optics Valley youth city, such as the atrium and corridors on the first floor, were shared by couriers and community residents; the openness of such spaces meant they had a high mobility. However, couriers' experience here, no matter whether they were working or living in this community, could be far different from that of a common resident. Researchers were interested in how they would actually feel when working or living in this community; therefore, they asked questions such as "How do you generally feel about the work and living experience here in this community?" and "What aspects in this place do you like or dislike?" to form courier group's common attitude.

Adding up more than 100 answers from couriers, researchers were able to reach a few conclusions. Optics Valley youth city was a community with very dense apartment and population density, and a large number of people living here were newcomers in the city with a very high mobility (often tenants). Considering this, it is not hard to understand the comparatively low rent, plain living conditions, and chaotic management status seen here. However, there are exactly the traits that made Optics Valley youth city an ideal place for gig workers with some informality, and, among them, food delivery couriers. To make a comparison, this community for Wuhan was similar to Kowloon Walled City for Hongkong, a contemporary match for newcomers in town with informal gig jobs and a comparatively rough living environment.

As analyzed in this chapter, the mobility characteristic of food delivery couriers is precisely influenced by the public space. Of course, their behavioral characteristics are also influenced by external factors such as platform algorithms, market conditions, and weather conditions, but it is indisputable that factors such as the business type, quality, population size, and openness of urban public space influence the behavior of food delivery couriers and produce a group behavior pattern that is specific to couriers.

## 6. Food Delivery Couriers' Tactics

### 6.1. Public Space Redistribution—Conflict and Compromise

Before the takeaway restaurants entered the Optics Valley youth city community on a large scale, the public spaces in the community were mainly used by community residents. The fresh market on the south side of the community would also attract residents from the surrounding communities. With the expansion of takeaway restaurants in the community as well as the low rental costs and dense residential units in that community, more and more food delivery couriers chose to use Optics Valley youth city as their workplace and entered the community public space.

When food delivery couriers enter the community, they become new users in the community public space and inevitably conflict with the original residents of the community. Firstly, their number grows rapidly, and they stay in the community for a long time during working hours. Each courier and his electric motorcycle form a larger spatial unit, which occupies the public space of the community in a large and disorderly way. Second, they often need to ride fast in the community during peak hours, which affects the pedestrian safety of the community's public space. They also reinforce this "space occupation" by

forming their own groups, and their behavior is a change to the existing order of public space, and therefore faces some resistance from the residents.

Due to the large number of residents in the Optics Valley youth city community, their high mobility, and complex demographic composition, it is difficult for residents to form a community voice; thus most of the time it is the residents' committee that manages the community space on behalf of the residents. The residents' committee has been strengthening the management of public space in the community, especially the issue of public space ownership. For example, the residents' committee has restricted food delivery couriers from riding to the second floor to pick up food to ensure that community residents can use the second-floor space, and has designated specific activity spaces for the elderly and children in the community.

The "competition" between couriers and residents for public space also came to a balanced conclusion after a long time, with couriers finding a space model that allows them to work efficiently under the management of the community. At present, we can find a compromise between the residents and the couriers, with the two groups forming their own order. There is some spatial stratification here: Couriers use the ground floor of the community atrium, and only the north part of the ground floor where the takeaway restaurants concentrate, while leaving the second and first floor to the residents of the community.

## 6.2. Collaboration with Multiple Groups for Public Space Renewal

The community public space was originally designed based on the pedestrian activities of the community residents, and less consideration was given to the needs of non-motorized vehicles. After the Optics Valley youth city community became host to the largest concentration of food delivery couriers in the area, the community needed to cater to a large number of non-motorized vehicles. Couriers started to directly cooperate with some takeaway restaurant owners to build ramps next to the steps in the community to allow electrical motorcycles to pass smoothly. At the same time, the couriers also used their motorcycles to define their own spatial units in the open spaces of the community and find places to sit and lie down. Through their bodies and tools, they reshape spatial boundaries in a flexible way, which also forms an expression of new social relations.

There is also some indirect cooperation happened in this community. Such as food delivery couriers' "invasion" presents new challenges for community managers. The managers put more emphasis on their management responsibilities, setting up flowerbeds and fences to restrict couriers' working space. They also set up courier recreation areas in some gray spaces.

There is little service infrastructure in the original community public space before, and the "invasion" of food delivery couriers has created new demand for the functions and resources of the public space. This demand has been met by some companies, which have developed products especially for couriers, such as shared lockers and charging piles, and implemented them in community public spaces.

To sum up, the current shape and function of public space in communities are the result of many tiny spatial updates, and such spatial updates are conducted through collaboration between couriers, residents, community managers, and other groups.

The tactics demonstrated by food delivery couriers are precisely the result of their interaction with urban public space. In other words, the relationship between food delivery couriers and urban public space is two-way; the characteristics of urban public space influence the behavior of couriers, while couriers, as a new group of gig workers in the city, are always involved in reshaping the public space with the city.

## 7. Discussion and Conclusions

The working conditions [45], labor rights protection [46], and the relationship with platform algorithms [47] of food delivery couriers have been widely studied, while the relationship between couriers and urban public space was overlooked. This study focused on how couriers interact with urban public spaces. We also analyzed their behavioral logic

and spatial tactics in detail. This can help us understand the characteristics of couriers' behavior in the city and expand our knowledge of urban public spaces.

First, in traditional urban planning, the functions of urban space are determined. However, our study found that the features of public space, such as function, ownership, and form, change dynamically in real life, and these features will change with the change in the users. After coordinating the needs of various groups, public spaces will be in a state of "dynamic balance". Since most gig workers in cities are migrants and highly mobile, they are often regarded as urban "invaders" in our city [31]. However, our study concluded that gig workers such as food delivery couriers interact closely with urban public spaces and participate in shaping the characteristics of public spaces; thus, they should be regarded as users of urban public spaces. Especially in the period of the rapid development of the Internet economy, the number of gig workers employed by online platforms is larger and growing more rapidly than that of traditional gig workers. According to Ali Research Institute's forecast, about 400 million people in China will participate in the gig economy in 2036, including e-commerce, transportation, and space sharing [48]. As such, they enter urban public spaces in a more disorderly manner, and as an important variable in urban public space, they are deeply involved in the "dynamic balance" of public space. City managers should not ignore the needs of this group [30]. Taking this phenomenon as an inspiration, if gig workers are included in the design of urban spaces at an early stage, their working environment will be greatly improved. Moreover, through the design of urban space, we can establish a standardized order for the originally "atomized" gig workers, avoid the urban conflicts and problems caused by their disorderly activities, and promote the realization of social justice in urban public spaces.

Secondly, public space is the place where every space user's daily life unfolds [26], and as our study stated before, the evolution of public space is a continuous process composed of multiple interventions. No participant should be neglected. Food delivery couriers are a representative group of the modern urban mobile population [12]. They are an indispensable part of urban life, and while serving urban life, they are also involved in the use and renewal of urban public space.

Therefore, in practice, a long-term and effective dialogue platform should be established to allow efficient and organized communication among the various groups using public spaces, which is lacking in most cities now [49]. Such a system can change the state of urban public spaces according to changes in the users in the area, instead of creating a "silent struggle and compromise" to renew the public space [31]. Especially for China at this stage, the period of rapid urbanization without quality has passed. The focus of urban development will gradually shift to the renewal of urban built-up spaces [50], and sustainable development will become a key goal of future urban development [51]. In such a context, a people-oriented and multi-participant urban space evolution is a sustainable urban renewal approach.

Finally, our findings show that food delivery couriers provide simple, repetitive, and common labor and an important basis for citizens' convenient lives because of their quantity. They establish a new order in urban public spaces and shape a workspace that suits them. In this process, they overcome the contradictions of the status quo and establish their own identity in the city. However, such an identity still needs to be safeguarded by relevant laws and industry regulations. At the moment, food delivery couriers still experience difficulties in identifying labor relations, lack social security, and have irregular work schedules, which make it difficult to protect their labor rights and interests. Relevant laws and regulations need to be improved. At the same time, takeaway restaurant operators, as an important part of the takeaway economic chain, also need to strengthen their industry responsibility to provide the necessary service facilities and a good environment for couriers. This can include setting up a separate work area to receive orders, providing necessary isolation from the rest of the restaurant, and reserving a rest space.

However, some limitations should be noted. The first is the limitation of time. The takeaway industry in China is still in a period of rapid development, and our study focuses

on a certain period of time, so there are inevitable limitations in time. Secondly, there are limitations in the geographical area of the sample we selected, as the subjects we chose are representative, but still lack comparative analysis with samples from a wider area. Therefore, based on the above two limitations of this study, we believe that future studies can be conducted with a longer observation time and comparative analysis of samples from different regions. In addition, other types of gig work in the city, such as cleaners and chauffeurs, can also be studied, and their interaction with urban public space is also worth studying.

This study presents a case study of a representative urban area, and through a microscopic perspective, we accurately and deeply explore the two-way relationship between food delivery couriers and urban public space, revealing the spatial patterns and tactics of gig workers in public spaces. We hope that this study can provide a reference for other areas facing similar social phenomena.

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