land

MDPI

*Article*

# Evaluating the Effectiveness of Community Public Open Space Renewal: A Case Study of the Ruijin Community, Shanghai

**Yidan Cao and Xiaomin Tang ***

Department of Landscape Architecture, School of Design, Shanghai Jiao Tong University, Shanghai 200240, China; eden-cao@sjtu.edu.cn

* Correspondence: xmtang@sjtu.edu.cn

**Abstract:** As a vital component of public space, public open space (POS) is considered crucial for community regeneration. However, most evaluation studies have focused on the geographical attributes of POS, and those assessing renewal holistically in terms of residents' everyday lives are limited. Drawing on the Ruijin community in Shanghai, this study compared networks of public space layout and residents' daily behaviours as a function of their structure and individual nodes using the Social Network Analysis method to explore the characteristics and evaluate the effectiveness of renewal. The results showed: (1) the current renewal while increasing recreational opportunities and improving spatial appearance has had a limited effect at the social level. (2) There are differentiations between the two networks. POS plays different roles in the behavioural network, including comprehensive, intermediary, and directional nodes. (3) The core POSs have frequent interactions and strong links with specific types of public facilities than the periphery. Therefore, we suggested that POS renewal should be conducted according to the rule of "core preceding periphery, comprehensive high-efficiency preceding single low-efficiency" and explain the necessity of public participation in the process. These findings shed light on the potential mechanism of the impact of POS on everyday life and rethink the construction management and governance of urban community regeneration in the era of sustainability.

**Keywords:** urban renewal; community; public open space; effectiveness evaluation; social network analysis; Shanghai



**Citation:** Cao, Y.; Tang, X. Evaluating the Effectiveness of Community Public Open Space Renewal: A Case Study of the Ruijin Community, Shanghai. *Land* **2022**, *11*, 476. https://doi.org/10.3390/land11040476

Academic Editors: Guiwen Liu, Edwin H. W. Chan, Queena K. Qian and Taozhi Zhuang

Received: 8 February 2022
Accepted: 24 March 2022
Published: 25 March 2022



## 1. Introduction

Community is a complex of geographical space and social networks [1]. The geographical spaces, consisting of public spaces, service facilities, architectures, and policy systems, may have a clear administrative boundary or just be a vague geographical concept. In a given geographical space, intimate or nonintimate social activities and interactions between residents form the social network [2]. Strong connections with high frequency and short paths, i.e., intimate relationships between residents and their family members, lovers, and close friends, are prerequisites for forming the network. Residents can obtain more social support from this relationship but usually receive limited information and social capital [3]. The development and the expansion of social networks depend more on the "weak ties" of "bowing acquaintance", i.e., nonintimate social relationships. In a specific community space or social activity, nonintimate relationships play a vital role in creating social capital, increasing the sense of place and identity and enhancing community cohesion [4,5]. A social network formally features a looser and more alienated structural feature than geographical spaces. Residents may break through geographical boundaries for their benefits, interests, and emotions by carrying out activities outside the communities [6]. Therefore, the close dependence and the structural differentiation of geographical spaces and social networks are essential characteristics of communities.

Public open space (POS) is an integral part of community public space, considered an outdoor living space with a minimal cost, reasonable distance, and a high-quality

environment to achieve maximum social communication [7–9]. Some scholars believe that any outdoor space which is open to the public free of charge and provides recreational services is a POS, which is generally not restricted by land attributes [10,11]. Parks and public squares are typical POSs. Affiliated green spaces, pocket parks, corner gardens, pedestrian streets, and grey spaces outside architectures for people to stay and relax fall within this category. Inaccessible enclosed green spaces or abandoned spaces in the community also have the potential to be converted into POS. In China, there are two general approaches to POS development and management: one is under the sole responsibility of government departments, and the other is private development by property developers under the supervision of the government. The latter is generally abbreviated as POSPD in some of the previous studies on urban public space in China [12,13]. POSs and indoor public service facilities form the system of public spaces known as the "third place", in addition to the family and workplaces. They not only provide a physical environment for people to conduct various activities but also a social environment that can promote broader social interaction between strangers [14]. In recent years, a few studies have shown that POSs have a positive impact on residents' physical and mental health [15–18]; promote the formation of "weak ties" [19]; and improve residents' sense of happiness, belonging, and cohesion [16,20,21], thereby accumulating social capital and social wellbeing [22,23].

Under endogenous development, the community has become the basic unit of urban regeneration and innovation governance. Since the outbreak of SARS-CoV-2, various countries have been concerned about the construction of the community life circle and the 15–min city concept [24]. Chinese urban communities have also experienced a large-scale regeneration of public space in the last five years. Improvement of community public space, such as street walkability, accessibility, diversity, and fairness of facilities, and environmental comfortability, have been reemphasised [19,25]. In particular, the renovation and activation of POSs have become a top priority [26]. The general renewal model focuses more on transforming the POSs' physical attributes, such as increasing their number, expanding their scale or improving their accessibility for idealised structures. In China, especially, those types of renewals are popular in old communities and urban villages in some urban central areas that face complex demographic structures, rigid social relationships, limited space resources, and prominent aging problems [27,28].

Those projects easily neglect the role of each POS node in residents' everyday lives, resulting in the encroachment and destruction of their original living spaces and neighbourhood social network. In addition, they may also trigger environmental justice and social deprivation [29] and affect community awareness [30,31]. Therefore, it is likely to depart from the expectations of Chinese society, which has long been known as "relation-oriented" to community POS renewal. In this regard, our research aims to develop an evaluation method to assess the effectiveness of POS renewal in urban communities from the perspective of residents' daily lives, compare the differences between social and spatial dimensions, and further discuss and elaborate on the entanglement between urban regeneration and people's growing needs for community POSs in recent years.

## 2. Literature Review

The extensive body of literature on POS evaluation is mainly based on structuralist thinking regarding functionalism, including macro and micro perspectives. In recent years, the evaluation at the macro level usually involves big data, such as geographic data, community population data, mobile phone signalling data, and POI data, whereby calculations and measurements of the POS numbers [32], scale [17], accessibility [10,33], greening coverage rate [34], and vitality [35] were conducted, using overlay analysis, kernel density analysis, spatial syntax, GIS network analysis, the two-step floating catchment area method, etc., to evaluate the layout fairness, as well as the supply-and-demand matching degree of a specific administrative division, such as a district or the whole city. Some studies also implemented machine learning to delineate the size of a community's life circle or employed semantic segmentation to qualitatively assess the quality of POSs using social

platform data [36]. It is undeniable that macroscale research can successfully reflect the characteristics of the overall network, and that big data can provide a larger sample size for research, thus allowing researchers to discuss the role and value of public spaces in a larger context. However, it is often difficult for big data to reflect the emotions, events, behavioural background and other information behind the data. It is easy to ignore the use behaviour of spaces by some groups, such as the elderly and children. Although some researchers conducted online or offline questionnaires to supplement background information and explain causality or overlap time profiles to discuss the spatiotemporal variation of indicators to make up for this drawback, their effect was limited. For community POSs, existence does not mean rationality, and a large number or a close distance with residential areas does not indicate fairness. Macroscale research essentially tends to fall into the stereotype of egalitarianism. Thus, there are many intricate problems and data acquisition defects in the community that may easily break the studies away from the "human-centred" core and constraints by geographical space and administrative regulation.

Microscale evaluations can fully reflect the internal characteristics of space and the people's usage of areas. As for data collection, the research is mainly engaged in qualitative approaches, such as interviews, questionnaires, ethnography and participant observation. Some studies also combined these data with remote sensing maps, UAV technology, mobile positioning technology or smartphones. In data analysis, evaluation systems and audit tools are usually used to assess the environmental quality or the response of space functions to people's needs. In terms of quality assessment, Pasaogullari et al. used a satisfaction questionnaire to evaluate a public space using the four dimensions of accessibility, security, facility quality and aesthetics [37]; Giles-Corti et al. developed the public open space tool (POST) to evaluate a POS in terms of activities, environment, convenience, and security [38]. Based on POST, Edwards et al. developed a public open space desktop audit tool (POSDAT) that allows assessments to be conducted using remote-sensing maps [39]. Concerning the demand response, Gehl et al. used the Public Space and Public Life (PSPL) tool to summarise the characteristics of residents' activities in urban spaces [40]. Sun et al. analysed the possibility of small-scale space optimisation by observing the behaviour of older residents in street corners of an old city zone [41]; Roy et al. used grounded theory to study women's sense of security in public spaces in Kolkata, India [42]. Considering the aspect of behaviour, some researchers used people's travel routes to analyse different areas in POS. Zhai et al. used GPS trackers to observe tourists' activities, the intensity of the space's use, and the time spent in the park [43]. Andrew et al. used the GPS positioning function of smartphones to analyse university students' choice and use of urban green spaces [44]. Nevertheless, microscale evaluations are often subject to multiple samples, and studies typically focus on specific space types or particular groups [26,45], aiming to reflect the various attributes of isolated "points", with limitations when reflecting the network of POS.

Overall, the evaluation of community POSs needs to integrate overall network thinking and individual analysis, as well as clarify the roles of POSs in community residents' everyday lives. In this regard, social network analysis (SNA), a sociological research paradigm that matured in the 1970s, can provide new ideas [46]. This method deconstructs complex relational networks into nodes and links, focuses on the role of nodes in the network and the "relationship" between nodes and then reveals the operation law of complex relational networks. It also provides an analytical tool for the accurate quantification and visualisation of network and node characteristics. Since the nodes in an SNA can be specific people or groups, as well as streets, bus stations, cities, or even countries, it provides an operational path for analysing various types of network relationships, and it has been introduced into political economy, epidemiology, Internet studies, traffic planning, rural research, and other fields [47–51]. In urban community studies, SNA can take the community as a platform to integrate the macro society and micro individuals, break community research limitations related to functionalism and evaluate the characteristics and functions of POSs in the network [52]. It can also break through the perspective of structuralism and

provide theoretical support for the renewal of community public spaces to promote social integration and neighbourhood communication.

Based on the above, we asked the following research questions: (1) Is there a difference between the layout of community public spaces and their actual use by residents? (2) What role do the POS nodes play within residents' behaviour networks in emphatically renewed communities? (3) What is the relationship between POSs and other public service facilities? (4) Is the current approach to community POS renewal effective at the social level?

Our research would assess the effectiveness and explore the priority of the implemented community POS renewal by using the SNA method to compare the residents' daily use with the spatial layout of the renewed POS. Firstly, we conducted fieldwork on residents' everyday outdoor activity preferences and patterns in the representative community. Secondly, we constructed two network matrices by investigating the daily activities of community residents, taking the public spaces where the residents conducted their activities as nodes and using their walking routes and the spatial distance between the nodes as links. The spatial matrix reflected the layout of community public space nodes within a 15-min walk (800 m), and the behaviour matrix represented residents' actual use of public spaces. Then, SNA was used to explain the characteristics and functions of community POSs in residents' daily lives in terms of the network and the node, identify the renewal priority of POSs and evaluate the effect of POS renewal. The research framework is shown in Figure 1.

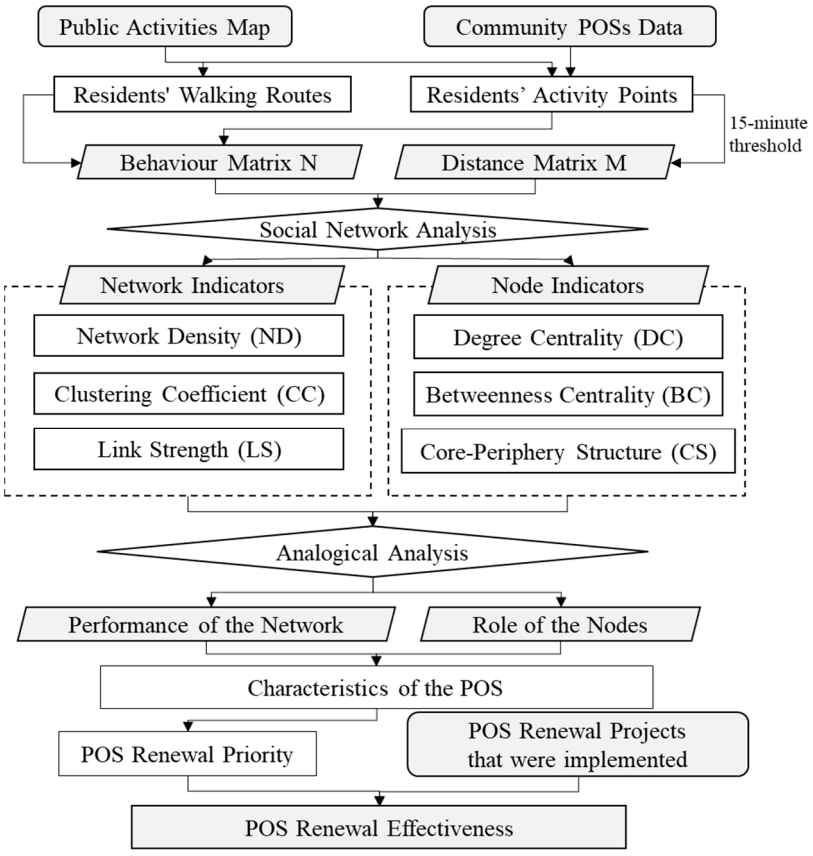



**Figure 1.** Research framework.

## 3. Methods

### *3.1. Study Area*

The Ruijin community is located in the western part of Huangpu District, the central urban area of Shanghai, covering an area of 1.95 km$^2$, with a population of 52,900 people and a population density of 27,100/km$^2$, is a typical high-density community [53]. The

community, which was built in the early 20th century, was a part of the French Concession. Most of its areas belong to the Hengfu historical and cultural area. The architectural form of the community has distinct Shanghai-style features, mainly including new-style lanes (Li long), garden houses, and modern apartments. Ruijin is the most culturally diverse, commercially prosperous, and socially vibrant community in Shanghai, which is well equipped with various public service facilities, rich in cultural and art resources, and most residents have a well education.

However, in the process of urban modernization since the reform and opening up, facing the surge of floating population and the severe aging problem, the old and narrow community space and service facilities have gradually been unable to meet the residents' increasingly diverse activity needs and environmental pursuits. Therefore, the government has carried out several rounds of community public space renewal in recent years and has already become one of the most representative samples in Shanghai. According to the definition of a POS in this study, there are 17 POSs in the Ruijin community and three POSs marked by residents in the follow-up surveys but outside the administrative boundaries (Figure 2, Table 1).

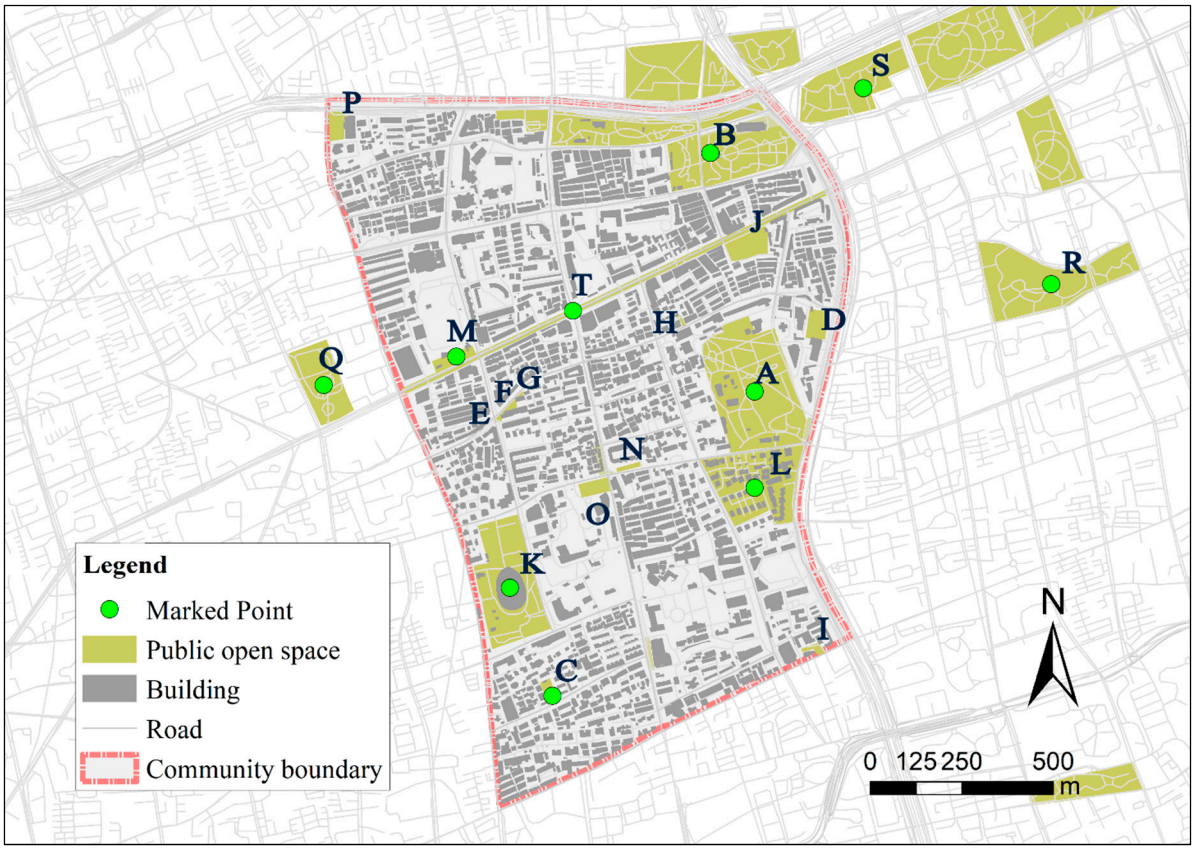



**Figure 2.** Map of POSs in the 15-min life circle of Ruijin community.

**Table 1.** Information of the Ruijin community POSs.

| Number | POS Name | Area ($hm^2$) | Space Type | Managed by |
|---|---|---|---|---|
| A | Fuxing Park | 8.89 | Comprehensive park | Government |
| B | Ruijin Section of Yanzhong Park | 7.71 | Comprehensive park | Government |
| C | Shaoxing Park | 0.24 | Community park | Government |
| D | Magnolia Garden | 0.37 | Pocket park | Government |
| E | Reading Garden | 0.006 | Pocket park | Government |
| F | Xunfang Garden | 0.06 | Pocket park | Government |
| G | Wei Garden | 0.002 | Pocket park | Government |
| H | No. 168 Nanchang RD Garden | 0.02 | Pocket park | Government |
| I | No. 8 Bridge Entrance Square | 0.14 | Entrance Square | Corporate |
| J | Yuyangli Square | 0.62 | City square | Corporate |
| K | Shanghai Culture Square | 5.37 | City square | Corporate |
| L | Sinan Mansion | 4.81 | Pedestrian area | Corporate |
| M | Huaimao Greenland | 0.18 | Street green space | Government |
| N | Cross of Fuxing RD and Ruijin RD | 0.08 | Street green space | Government |
| O | Cross of Fuxing RD and Ruijin RD | 0.32 | Street green space | Government |
| P | Cross of Shaanxi RD and Yan'an RD | 0.32 | Street green space | Government |
| Q | Xiangyang Park * | 2.31 | Comprehensive park | Government |
| R | Huaizhong Section of Yanzhong Park * | 8.79 | Comprehensive park | Government |
| S | Taiping Bridge Green Space * | 4.10 | Community park | Corporate |
| T | Huaihai RD Commercial Street | - | Pedestrian Street | Government |

* This node is outside the administrative boundary of the Ruijin community.

#### 3.1.1. Problems of POSs in the Ruijin Community

Through the preliminary research, there are two problems with the POSs of the Ruijin community. First, due to the high population density and architecture and the policy requirements of neighbourhood conservation, the public space for residents' recreational activities was very limited. Although the total area of the public open space in the Ruijin community was about 29.14 $hm^2$, the per capita public space area was 5.51 $m^2$, which exceeded the public space construction goal of 4 $m^2$ per capita required by the 2035 overall urban planning of Shanghai. Previous studies also showed that the supply and demand of POSs in the Ruijin community are highly correlated with indicators such as location entropy and accessibility [19,54,55]. However, these data may ignore a large number of tourists and surrounding residents attracted by nodes, resulting in an overestimation of the supply level and failing to explain each space's role in the traffic network of residents. Second, the relocation and the renewal of the old community broke the neighbourhood social network that was maintained for decades, causing the loss of intimate and mutually supportive social relationships between old residents. At the same time, new immigrants actively avoid contact or lack the opportunity to establish contact with the original residents due to time factors or economic factors, and even accent and dialects differences, eventually leading to a loss of the resident's sense of identity and belonging.

#### 3.1.2. POS Renewal of the Ruijin Community

During the 13th Five-Year Plan period, the Huangpu District Government carried out public space renewal and governance of the Ruijin community from the aspects of "quantitative and qualitative improvement" and "co-governance promotion", and a 15-min community life circle study was conducted. The "quantitative improvement" is reflected in creating POSs by tapping the potential of sporadic micro-spaces, transforming inaccessible roadside green spaces into pocket parks and establishing indoor public activity facilities, such as community reception halls. The "qualitative improvement" mainly refers to the basic facilities being upgraded and streets being beautified, e.g., spaces were cleaned up, pavements were updated, walls and shop brands were beautified and overhead lines were landed. "Co-governance promotion" is reflected in the co-construction of a co-governance platform for residents and a mutual assistance alliance for merchants, aimed at improving

residents' satisfaction, sense of belonging and cohesion by increasing their enthusiasm for participation. Over the past five years, the renewal and governance of public space in the Ruijin community have mainly focused on improving the landscape around Fuxing Park, especially in the eastern section of Nanchang Road, which is an exemplary development in Shanghai, and even in China.

### *3.2. Data Collection and Measurement*

From July to September 2021, the research team conducted fieldwork in the Ruijin community and surveys of its residents. A total of 320 questionnaires were distributed and 298 valid questionnaires were received. The questionnaire included questions on the respondents' personal information, daily activity preference, satisfaction with POSs, and willingness to reside in this community and a map tracking their activities. All abbreviations of relevant terms and indicators can be found in Appendix A at the end of the paper.

#### 3.2.1. Network Matrix Formation

The formation of a network consists of nodes and links. First, according to the classification standard of public spaces in the "Shanghai Planning Guidance of 15-Minute Community-Life Circle", activity stay points were classified and POS nodes were selected. Second, the geographic information of all stay points was put into ArcGIS. Then, a spatial network matrix M was constructed based on the physical distances between nodes, which were measured with a threshold of 800 m, i.e., the maximum distance that can be reached in 15 min by walking. Lastly, the behaviour network matrix N was constructed using the map tracking residents' activities, whereby a link was established between two nodes when a respondent moved from one node to another.

#### 3.2.2. Network Structure Indicators

Calculations of the Network Density (*ND*), Clustering Coefficient (*CC*) and Link Strength (*LS*) of Distance Matrix M and Behaviour Matrix N Using the Network Tool in UCINET.

(1) *ND* is the ratio of the actual number of links between nodes to the maximum number of existing links, representing the density of the whole network. The calculation Equation is

$$ND = \frac{l}{N(N-1)} \tag{1}$$

where *ND* is the network density, *l* is the actual number of links in the network, and *N* is the number of nodes.

(2) *CC* represents the degree of clustering between nodes in the network. A larger value denotes greater interaction between the nodes and a stronger clustering trend. In a spatial network, a closer distance results in easier clustering; in a behaviour network, a more frequent use of nodes results in easier clustering. The calculation Equation is

$$CC = \frac{k}{T} \tag{2}$$

where *CC* is the clustering coefficient, *k* is the number of closed three-tuples in the network and, *T* is the number of all three-tuples in the network.

(3) *LS* represents the degree of association between two nodes and is the frequency of links between nodes, as shown by the thickness and colour of the links in a network graph. In a spatial network, the closer two nodes are, the stronger the link is; in a behaviour network, the more frequent the activities of residents between two nodes are, the stronger the link is. For the convenience of analysis, the link strength was divided into five grades using the natural breakpoint method in the visualisation.

3.2.3. Node Indicators

Calculation of the Degree Centrality (*DC*), Betweenness Centrality (*BC*), and Core–Periphery Structure (*CS*) of Each Node Using the Centrality Tool in UCINET.

(1) *DC* represents the importance of nodes in the network, which can reflect the influence of nodes in the network. In a spatial network, it represents the ability of a node to establish an accessible association with other nodes within the threshold of the 15 min walking distance, whereby a higher degree centrality denotes that the facility is closer to the geometric centre of the network; in a behaviour network, it represents the demand degree of nodes in residents' daily travel, whereby a higher degree centrality denotes a greater possibility of residents carrying out various activities and social interactions at this node. The calculation Equaiton is

$$DC_i = \frac{k_i}{N-1} \tag{3}$$

where $k_i$ represents the actual number of edges connected to node $i$ and $N-1$ represents the maximum possible number of edges connected to node $i$.

(2) *BC* reflects the mediating role of nodes in the network and the control force of a node on other nodes, as measured by the number of shortest paths passing through the node. In a spatial network, it represents the ability of nodes to act as "bridges" between remote nodes; in a behaviour network, it represents the ability of nodes to act as a transfer station, whereby high betweenness centrality denotes that the node is one that residents must pass through when going to a node of high degree centrality. The calculation Equation is

$$BC_i = \sum_{s \neq i \neq t} \frac{n_{st}^i}{g_{st}} \tag{4}$$

where $g_{st}$ is the number of shortest paths linking $s$ and $t$ and $n_{st}^i$ is the number of edges that pass through node $i$ and the shortest path between $s$ and $t$.

(3) *CS* identifies the relative relationship between the core node and the peripheral node in the network by calculating the continuous core degree. Nodes with a core degree above 0.1 are considered core nodes, while the others are considered peripheral nodes. In a spatial network, the accessibility of core nodes is high; in a behaviour network, core nodes have a significant impact on the daily social network of residents.

3.2.4. Renewal Priority and Effectiveness Evaluation

Using the natural breakpoint method to process the *DC* and *BC* of each POS and overlay *CS*, we obtained the type and strength of the roles of POSs in the behaviour network; then, we judged their importance to residents' daily lives to determine their renewal priority. The renewal effectiveness was obtained by comparing the ideal priority with the actual POS renewal in sample communities from 2016 to 2021.

## 4. Results

### *4.1. Demographic Characteristics*

Table 2 summarises the descriptive statistics of the 298 respondents. The sample included 43.3% women and 56.7% men, of which, 41.9% had lived in or near the Ruijin community for more than 20 years. The elderly over 60 years old accounted for 54.3% of the respondents, while only 3.7% of respondents were under 17 years old. This age distribution ratio was consistent with the community census data. Among the respondents, 56.4% were retirees, while 35.9% had a monthly income of CNY 3000–5000. Furthermore, 73.8% had a high school education or above, while 29.5% of them had undergraduate or postgraduate degrees. Most respondents expressed an urgent need for high-quality community POSs.

**Table 2.** Descriptive statistics ($n$ = 298).

| Demographic Characteristics | | Number | Percentage (%) |
|---|---|---|---|
| Gender | Female | 129 | 43.3 |
| | Male | 169 | 56.7 |
| Age | Less than 17 | 11 | 3.7 |
| | 18–34 | 62 | 20.8 |
| | 35–59 | 63 | 21.1 |
| | 60–74 | 130 | 43.6 |
| | Over 75 | 32 | 10.7 |
| Employment information | Working staff | 57 | 19.1 |
| | Freelancer | 15 | 5 |
| | Emeritus and retired | 168 | 56.4 |
| | Migrant worker | 10 | 3.4 |
| | Unemployed | 2 | 0.7 |
| | Student | 46 | 15.4 |
| Monthly salary (CNY) | Less than 3000 | 66 | 22.1 |
| | 3000–5000 | 107 | 35.9 |
| | 5000–10,000 | 84 | 28.2 |
| | 10,000–15,000 | 30 | 10.1 |
| | More than 15,000 | 11 | 3.7 |
| Education level | Junior high school or lower | 78 | 26.2 |
| | High school/technical school | 99 | 33.2 |
| | Junior college | 33 | 11.1 |
| | Postgraduate | 77 | 25.8 |
| | Master's or higher | 11 | 3.7 |
| Residence duration | Just for work/education | 54 | 18.1 |
| | Less than 5 years | 58 | 19.5 |
| | 6–10 years | 28 | 9.4 |
| | 11–15 years | 17 | 5.7 |
| | 16–20 years | 16 | 5.4 |
| | More than 20 years | 125 | 41.9 |

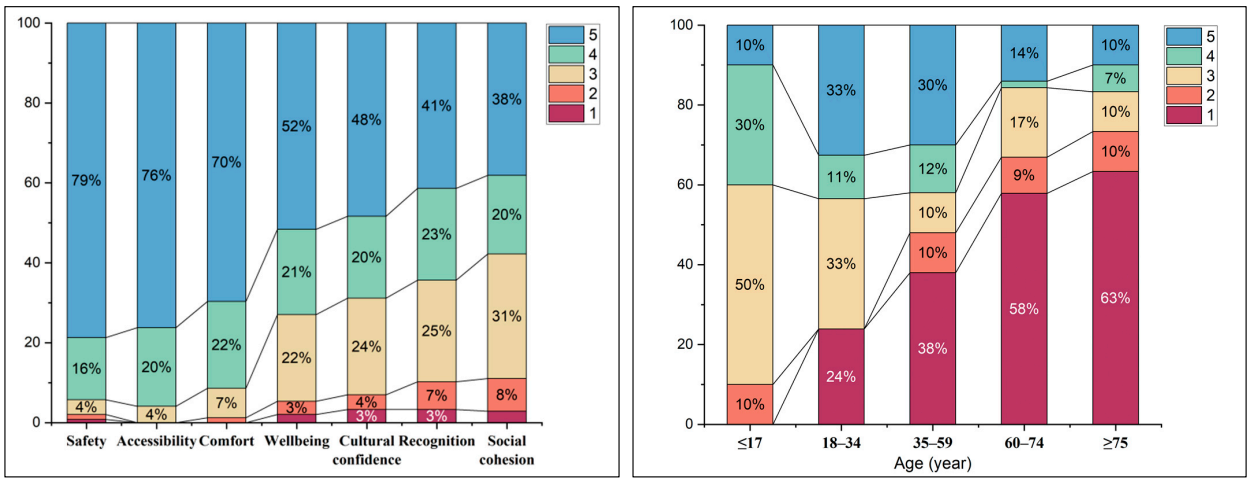
(1) Daily activity preference: Among the respondents, 75% chose to travel by walking or riding at 7:00–11:00 a.m. or 4:00–6:00 p.m., typically for 30–60 min, and their daily leisure activities were primarily strolling and exercising. Furthermore, 22.8% of the respondents also undertook social activities, such as playing cards or chess, drinking tea and chatting, and choir. Some respondents indicated that their daily outdoor activities usually covered multiple purposes in one trip. For example, one respondent exercised in the park (6:00–7:30 a.m.), shopped in the wet market (7:30–8:00 a.m.) and then took her children to primary school (8:00–8:30 a.m.).

(2) Satisfaction with POSs: The analysis using SPSS 23.0 revealed that the satisfaction questionnaire had good reliability and validity, with a KMO of 0.832, $p < 0.001$ and Cronbach's alpha of 0.828. According to the statistics, most respondents were highly satisfied with the safety, convenience and comfort of the community POSs. However, the satisfaction significantly decreased in terms of happiness, cultural confidence, and sense of belonging, along with even lower scores for community cohesion, indicating that the current POSs of the community did not entirely play their social role (Figure 3a).

(3) Residence willingness: The data showed that young and middle-aged residents were more willing to move out of the community, while older respondents who had lived there longer had a lower willingness to move out of the community (Figure 3). Further classification statistics showed that most young and middle-aged respondents living in rented apartments in the community had a low sense of belonging and identity. Their willingness to continue living in the community was not high. In contrast, the elderly residents who had lived in the community for more than 20 years were generally unwilling

to move out. This result could indicate a gap between generations and a disconnect between newer and older residents.

(4) Activity tracking yielded 298 travel tracks and 222 points, including 140 residential and 82 public space nodes. The public space types included medical care, elderly care, education, and businesses, satisfying all the space types required in the "Shanghai Planning Guidance of 15-Minute Community-Life Circle" (Figure 4). Within the 82 nodes, there were 11 community POS nodes marked by the residents, eight within the community administrative boundary and three outside the community (Table 1, Figure 2). No residents marked the other nine POS nodes within the administrative boundary in the survey.




(**a**) (**b**)

**Figure 3.** Residents' satisfaction with the POSs and willingness to remain a resident in the future. (**a**) Percentage stacked histogram of residents' POS satisfaction, scored from "5" to "1", representing "very satisfied", "satisfied", "normal", "unsatisfied", and "very dissatisfied". (**b**) Percentage stacked histogram of the residence willingness in each age group, scored from "5" to "1", representing "completely disagree", "disagree", "uncertain", "agree", and "completely agree".

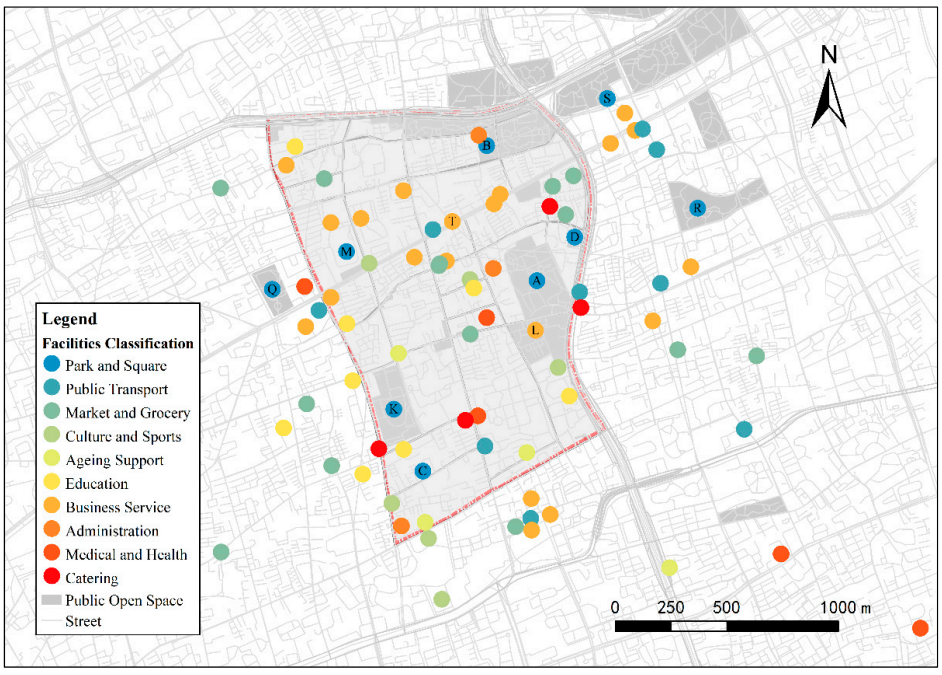


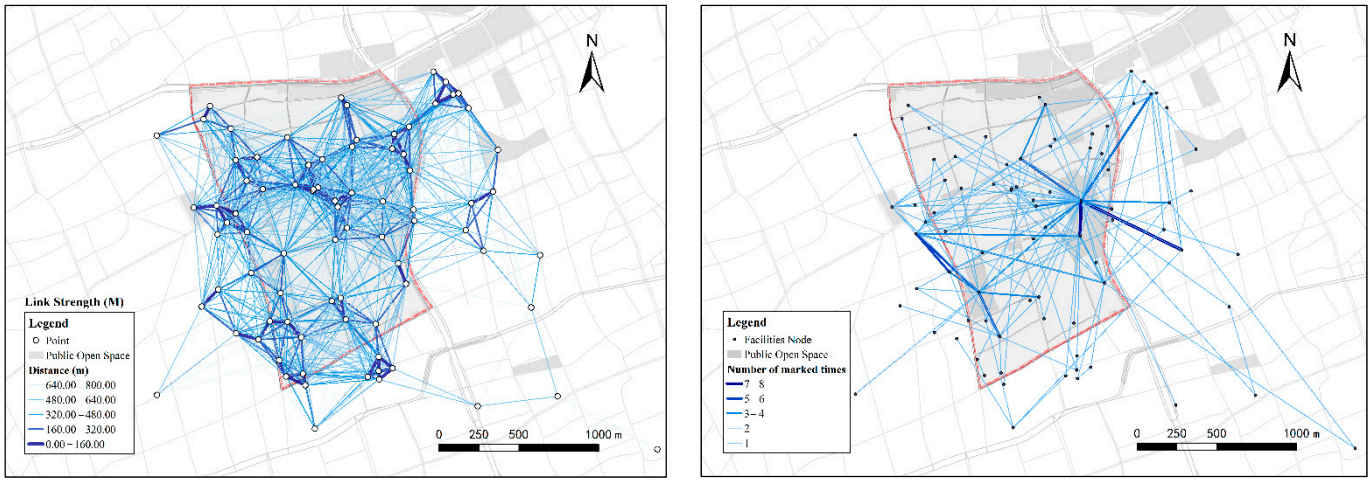

**Figure 4.** Map of public spaces marked by residents; nodes accompanied by letters are POSs.

### *4.2. Network Structure*

Table 3 indicates that the activity network of the community residents was more sparse and less cohesive than the layout network of the facility nodes. Through the *LS*, it was found that the facility nodes formed several small-scale and tightly clustered connection groups in space. These connection groups were distributed in the centre or the periphery of the community, corresponding to major business circles (Figure 5a). However, there were a limited number of strong links in the behaviour network, mainly between POSs, wet markets, and subway stations (Figure 5b), indicating that the residents' choices of daily activity spots were common and more life-oriented, and the tracks frequently overlapped between some nodes. Although the scale of the behaviour network was small, the residents' everyday activities broke through the layout preset by ideal planning, in addition to the incorporation of some nodes outside the administrative boundary.

**Table 3.** Comparison of indicators for the M and N matrices.

| Network Matrix | Number of Nodes | *ND* | *CC* |
|---|---|---|---|
| N | 82 | 0.0265 | 0.415 |
| M | 82 | 0.3415 | 0.723 |



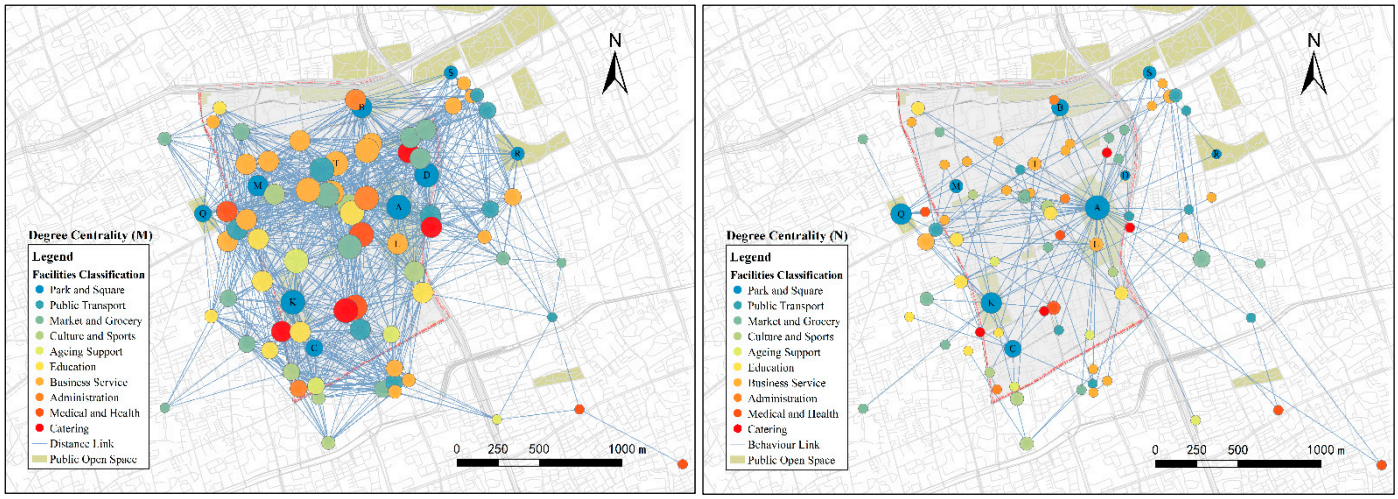

(**a**) (**b**)

**Figure 5.** *LS* between nodes: (**a**) *LS* in the spatial network; (**b**) *LS* in the behaviour network.

### *4.3. Node Characteristics*

#### 4.3.1. Degree Centrality

There was a small difference in the *DC* of each node in the spatial network M, with nodes closer to the community centre presenting a higher score; the scores of the POSs in the network were generally moderate or low (Figure 6a). In the behaviour network N, the *DC* of each node varied greatly, and its strength was associated with the space function (Figure 6b). Among the top 25 nodes, there were nine POSs, two subway stations, five schools, one general hospital, two shopping malls, two recreational and sports facilities, and four markets; the top five nodes were all POSs, including four parks and one public square (Table 4).




(**a**) (**b**)

**Figure 6.** *DC* of nodes: (**a**) *DC* in the spatial network; (**b**) *DC* in the behaviour network.

**Table 4.** Centralities of nodes in network matrix N.

| Name | *DC* | Rank | Name | *BC* | Rank |
|---|---|---|---|---|---|
| Fuxing Park | 62.896 | 1 | Fuxing Park | 80.562 | 1 |
| Shanghai Culture Square | 16.290 | 2 | Shanghai Culture Square | 12.965 | 2 |
| Xiangyang Park | 13.575 | 3 | Xiangyang Park | 12.209 | 3 |
| Shaoxing Park | 11.312 | 4 | Ruijin Section of Yanzhong Park | 8.138 | 4 |
| Ruijin Section of Yanzhong Park | 9.502 | 5 | Shaoxing Park | 7.907 | 5 |
| IAPM Shopping Mall | 8.145 | 6 | Shanghai Jiao Tong University | 4.524 | 6 |
| Wet Market in Madang RD | 7.240 | 7 | IAPM Shopping Mall | 3.328 | 7 |
| Commercial Street in Huaihai RD | 5.430 | 8 | Wet Market in Madang RD | 3.034 | 8 |
| Shanghai Jiao Tong University | 4.977 | 9 | Xiangming Junior High School | 2.678 | 9 |
| Metro Station in South Shaanxi RD | 4.525 | 10 | Metro Station in South Shaanxi RD | 2.106 | 10 |
| Ruijin Hospital | 4.072 | 11 | Yanzhong Park (Huaizhong Section) | 2.091 | 11 |
| Sinan Mansion | 4.072 | 11 | Wet Market in Jianguo RD | 1.287 | 12 |
| Grocery Shop in Nanchang RD | 4.072 | 11 | University of Shanghai for S&T | 1.191 | 13 |
| Fuzhong Wet Market | 3.620 | 14 | Luwan Stadium | 1.174 | 14 |
| New World Shopping Mall | 3.620 | 14 | Fuzhong Wet Market | 1.143 | 15 |
| Huaimao Green Space | 3.167 | 16 | Commercial Street in Huaihai RD | 1.103 | 16 |
| Julu Road No. 1 Primary School | 3.167 | 16 | Grocery Shop in Nanchang RD | 1.093 | 17 |
| Huaizhong Section of Square Park | 3.167 | 16 | Julu Road No. 1 Primary School | 1.078 | 18 |
| Metro Station in South Huangpi RD | 2.715 | 19 | Youth S&T Activity Center | 0.962 | 19 |
| Luwan Stadium | 2.715 | 19 | Noodle Restaurant in Yandang RD | 0.873 | 20 |
| University of Shanghai for S&T | 2.715 | 19 | New World Shopping Mall | 0.647 | 21 |
| Youth Activity Center | 2.262 | 22 | Ruijin Hospital | 0.603 | 22 |
| Sinan Kindergarten | 2.262 | 22 | Sinan Mansion | 0.528 | 23 |
| Xiangming Junior High School | 2.262 | 22 | Metro Station in New World | 0.501 | 24 |
| Wet Market in Jianguo RD | 1.810 | 31 | Xiangshan Hospital | 0.47 | 25 |

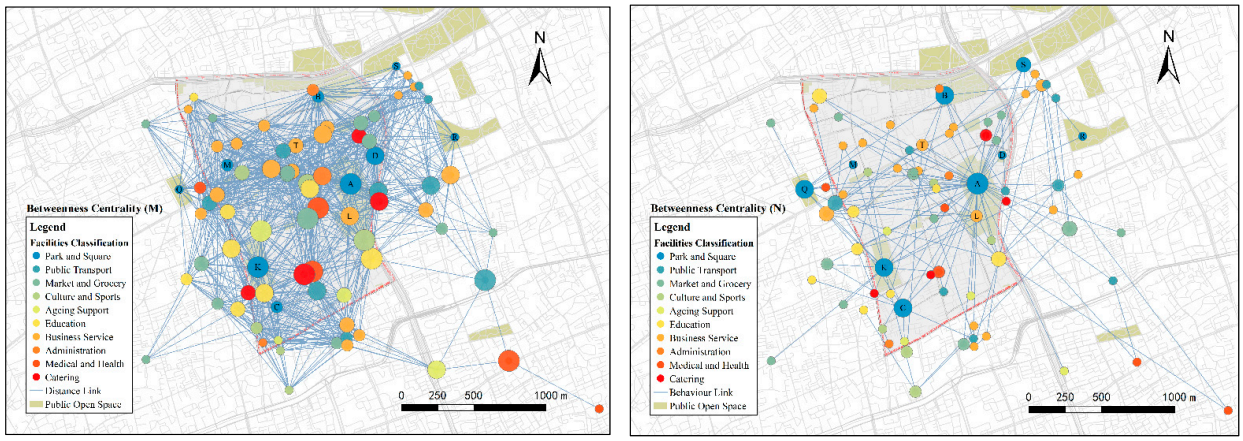
Nodes with coloured ranks are POSs. Only the top 30 of the 82 nodes are listed in this table.

Community residents' demand for POSs is very urgent, especially regarding parks. Fuxing Park (A) had the highest *DC*, denoting it as the most important social activity node in residents' lives. Cross-community activities were frequently conducted there, and some elderly residents even regarded "morning exercise in Fuxing Park" as their "job" after retirement. Shanghai Cultural Square (K) was closely connected with Shaoxing Park (C) and served as the core for activities in the southwest. Located outside the community, Xiangyang Park (Q) played a crucial role in promoting contacts and establishing "weak ties" between different communities, serving as a supplement to the activity spots in the northwest. Adjacent to a viaduct and fragmented by a few roads, the Ruijin section of

Yanzhong Park (B), located toward the northern boundary, had a slightly lower *DC* and was mainly used as a leisure place for residents in the north. Huaihai Road Commercial Street (T) and Sinan Mansion (L) exhibited a moderate *DC*. These two POSs were closely related to the nearby commercial facilities and constantly attracted residents. However, remote or small-scale nodes, such as Magnolia Garden (D), Huaimao Greenbelt (M), Taiping Bridge Greenbelt (S), and the Huaizhong section of Yanzhong Park (R), each had a low *DC*, indicating that residents hardly initiated activities at these nodes.

#### 4.3.2. Betweenness Centrality

The nodes with a high *BC* in the spatial network were mainly located in the centre of the multiple facilities or toward the community boundary, playing the role of "linking" remote facilities, which was not prominent in the behaviour network (Figure 7). As shown in Table 5, the top five nodes in terms of the *BC* were still POSs with a high *DC*, indicating that they were important activity spots for residents and served as temporary transfer stations for residents to go to other nodes for activities. The results also showed that public spaces, such as schools, sports venues and food markets, ranked significantly higher in terms of the *BC* than the *DC*, with a significant intermediary role and strong control over the daily travel network. For example, residents would stop by a wet market to buy food on the way to the park to exercise or send children to school before going to the subway station to work. The comparative analysis showed that the *BC* ranking of commercial affiliated POSs was generally lower than their *DC* ranking, indicating that these types of spaces mainly served as the destinations of residents' daily travel instead of stop-off points (Table 5).




(**a**) (**b**)

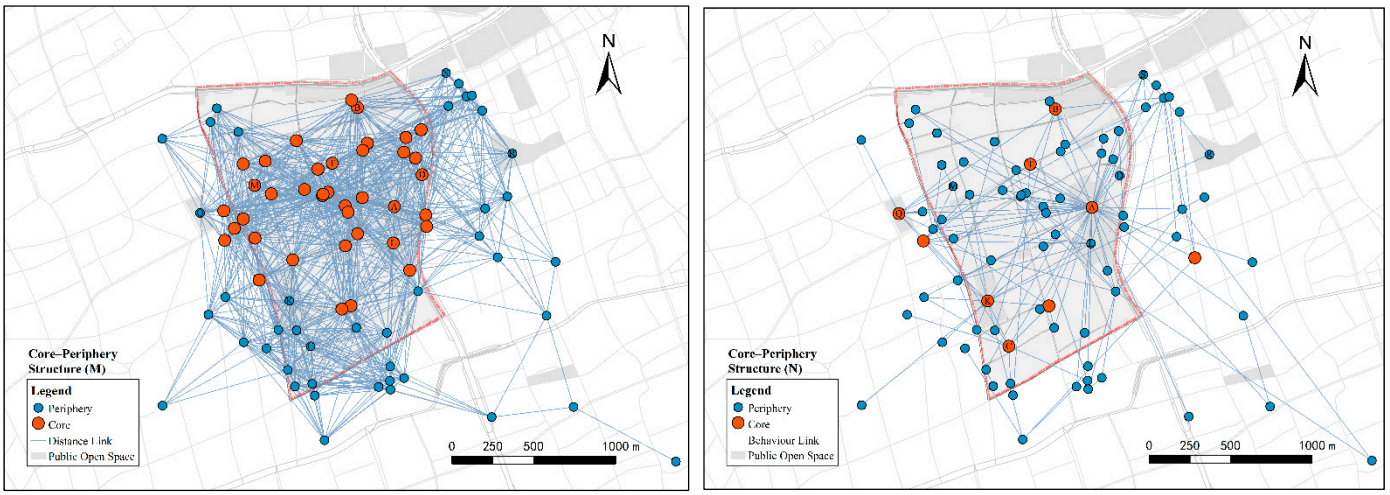
**Figure 7.** *BC* of nodes: (**a**) *BC* in the spatial network; (**b**) *BC* in the behaviour network.

**Table 5.** Comparison of the POS centralities in the behaviour and spatial networks.

| Node | Behaviour Network (Matrix N) | | | | Spatial Network (Matrix M) | | | |
|---|---|---|---|---|---|---|---|---|
| | *DC* | Ranking | *BC* | Rank | *DC* | Ranking | *BC* | Rank |
| A | 62.896 | 1 | 80.562 | 1 | 48.148 | 12 | 2.585 | 8 |
| B | 16.29 | 2 | 12.965 | 2 | 49.383 | 17 | 2.900 | 7 |
| Q | 13.575 | 3 | 12.209 | 3 | 29.630 | 49 | 0.324 | 65 |
| C | 11.312 | 4 | 7.907 | 5 | 48.421 | 18 | 1.251 | 27 |
| B | 9.502 | 6 | 8.138 | 4 | 39.506 | 36 | 0.859 | 47 |
| T | 5.43 | 8 | 1.103 | 16 | 45.679 | 14 | 1.183 | 34 |
| R | 3.167 | 8 | 2.091 | 11 | 18.519 | 73 | 0.015 | 79 |
| L | 4.072 | 14 | 0.528 | 23 | 43.210 | 21 | 1.834 | 17 |
| M | 3.167 | 17 | 0.446 | 26 | 40.741 | 31 | 0.856 | 48 |
| D | 1.357 | 33 | 0 | - | 45.679 | 14 | 1.631 | 21 |
| S | 0.905 | 40 | 0 | - | 23.457 | 65 | 0.390 | 64 |

#### 4.3.3. Core-Periphery Structure

Figure 8 shows the *CS* of the two networks. In the spatial network, there are a large number of core nodes clustered in the middle of the community. Nevertheless, there were only nine core nodes scattered in the behaviour network, including six POSs (Fuxing Park (A), the Ruijin section of Yanzhong Park (B), Shaoxing Park (C), Shanghai Culture Square (K), Xiangyang Park (Q), and Huaihai RD Commercial Street (T)) and three public facilities (Ruijin General Hospital, IAPM Shopping Malls and the wet market in Madang RD). In addition, the core nodes in the behaviour network had a stronger *LS* between each other than the periphery, which might mean more frequent related activities and social interaction (Figure 5).




(**a**) (**b**)

**Figure 8.** *CS* of nodes: (**a**) *CS* in the spatial network; (**b**) *CS* in the behaviour network.

### *4.4. Priority Analysis and Effectiveness Evaluation of POS Renewal*

By comparing the POSs centralities using standardisation and the natural breakpoint method, we divided the leading roles played by the nodes into four types: comprehensive, intermediary, directional, and no effect (Figure 9). Through an overlay of the *CS*, the POSs of the Ruijin community could be further divided into six types: comprehensive core nodes, intermediary core nodes, directional core nodes, intermediary peripheral nodes, directional peripheral nodes, and inefficient nodes. The POSs located in the core of the behaviour network and played a comprehensive role were key nodes closely related to residents' lives. As the space quality of these nodes directly affects the residents' daily lives, the need for their renewal is most urgent. Hence, we think that the renewal priority of community POSs should be conducted according to the rule that core nodes precede periphery nodes, comprehensive function nodes precede single-function nodes, and high-efficiency nodes precede low-efficiency nodes. Accordingly, the priority for POS renewal of the Ruijin community should be as follows: comprehensive core nodes > intermediary core nodes > directional core nodes > peripheral nodes > inefficient nodes (Table 6).

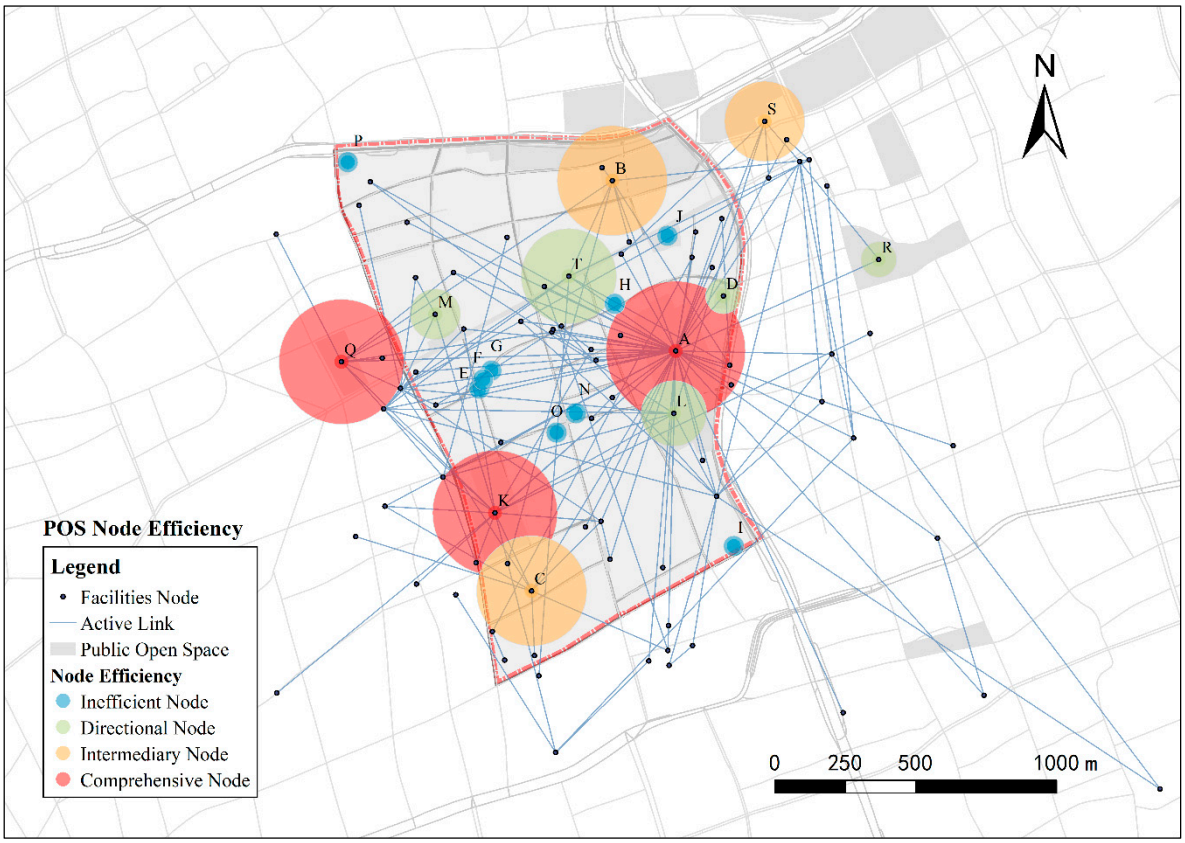



**Figure 9.** Node efficiency of the POS in the behaviour network.

**Table 6.** Analysis of the effectiveness and renewal priority of POSs in the Ruijin community.

| Priority | Node Type | Characteristics of Centrality | Node | Renewal [1] |
|---|---|---|---|---|
| I | Comprehensive core | Core nodes with a high *DC* and *BC* | A, K, Q [2] | Q [1] |
| II | Intermediary core | Core nodes with a moderately high *BC* | B, C | - |
| III | Directional core | Core nodes with a moderately high *DC* | T | T |
| IV | Intermediary peripheral | Periphery nodes with a high *BC* and a low *DC* | S [2] | - |
| | Directional peripheral | Periphery nodes with a high *DC* and a low *BC* | D, L, M, R [2] | D, L, M, R [2] |
| V | Inefficient | Unmarked nodes | E, F, G, H, I, J, N, O, P | E, F, G, H, J |

[1] POSs that were renewed between 2016 to 2021. [2] POSs are outside the community boundary.

However, the POS renewal of the Ruijin community from 2016 to 2021 mainly focused on directional or inefficient nodes that residents rarely use, while ignoring the renovation and improvement of comprehensive and intermediary nodes (Table 6). In the past five years, the "quantitative improvement" of POSs in Ruijin mainly focused on using small and fragmentary roadside green spaces or lane entrances under the leadership of the government or developers to pursue higher political or commercial benefits. The "qualitative improvement" actions were aimed at the streets instead of POS points. In reality, except for Xiangyang Park (Q) and Huaihai Road Commercial Street (T), most renewed nodes had low centralities and played a weak role in the behaviour network; thus, they were not effective in promoting neighbourhood communication.

## 5. Discussion

First, this study confirmed that the behaviour network of residents was smaller in scale and looser in structure than the spatial network [1]. As the geographical division in traditional urban renewal projects, administrative boundaries hardly ever can restrict residents' everyday lives. People often chose fixed activity stay points and walking routes according to their preferences for spatial functions, facility scale, and personal interests, reflecting and corroborating the dual attributes of the community. Second, this study explained the importance of considering the operation of social networks in community regeneration actions [6]. Residents' lives were closely related to POSs in the community, and there were differences in how POSs were used and the intensity of usage in reality. Based on the results, we believe that the planners need a more pragmatic and comprehensive perspective to set 15-min community life circle sustainable development goals in the context of urban regeneration. Thus, we suggest that the community public space renewal should focus on core POSs of the behaviour network, such as comprehensive parks, squares, and commercial pedestrian streets. Furthermore, this study found five types of public facilities with high centralities strongly linked with the core POSs, i.e., wet markets, schools, hospitals, recreational and sports facilities, and subway stations. We thought improving these facilities' outdoor spaces qualities may be more efficient than renovating abandoned spaces or closed greeneries, allowing residents to use and enjoy public spaces more directly and conveniently.

In terms of the characteristics of nodes, we classified the POSs of the community into six types. First, the three comprehensive core nodes of the Ruijin community had the characteristics of a long construction time, large space area and strong activity supply ability. These nodes were closely related to residents' daily lives, with a high possibility of forming "weak ties" [4,5], which may effectively bridge intergenerational barriers, promote the integration of original and new residents, to enhance community cohesion [52,56]. Second, directional core nodes were usually the only destinations or terminal points of residents' travel. Commercial Street in Huaihai RD (T) in the Ruijin community belonged to this type, and residents' leisure activities at this node were mainly due to the attraction of commercial facilities along the street. However, the types of activities that could be carried out at this node were relatively simple. Third, the intermediate peripheral node of the Ruijin community was located in the Huaizhong section of Yanzhong Park (R) outside the community, which played a similar role to Shaoxing Park (C), but with weak intensity. Directional peripheral nodes mainly allow individual residents to go to nodes for particular purposes. For example, office workers chose to have a lunch break at Huaimao Green Space (M), pet owners chose to walk their dogs in Magnolia Garden (D) and members of social organisations participated in activities in Taiping Bridge Green Space (S). Lastly, inefficient nodes included supplementary pocket parks, small and medium-sized commercial spaces and roadside green spaces. At present, residents rarely marked such nodes, indicating that such spaces emphasized in current development projects did not significantly improve residents' recreational opportunities or promote social interactions.

The effectiveness evaluation showed that adding more POSs did not necessarily create more leisure opportunities for residents or improve the overall POS utilisation rate. In this regard, we believe that there were three main reasons for the low efficiency and utilisation rate of the POS node renewal. First, there is a lack of practicability and sustainability of small spaces, such as pocket parks in the Ruijin community. These spaces are typically more like outdoor exhibition halls for the community government or merchants, designed to create internet-famous places or facades to solicit customers. They are usually only popular during leader inspections, tourist visits and reporter interviews. These spaces also fail to provide adequate care for vulnerable groups, such as the elderly, children, and the disabled [45,57], and do not establish connections with other public spaces. Then, the publicity and the openness of some nodes are not fully guaranteed. Although they are "public" in name, they are not "public" in reality. Government departments or relevant developers usually make decisions regarding space renewal. However, residents do not

even know the existence of these spaces or mistakenly assume that they are not open to the public [28,30]. In addition, combined with interviews, we found that many developers have strict restrictions on the activities of residents in the POSPD and often rely on dedicated security guards to keep the site in order, such as Sinan Mansion (L), Yuyangli Square (J) and No. 8 Bridge Entrance Space (I), making it difficult for residents to establish new social relationships there [12]. Furthermore, it also takes time for residents to become familiar with renewed spaces. Whether the design style of POSs is consistent with the community atmosphere, the facilities in the space meet the basic leisure needs of residents, and the government effectively guides residents to use new POSs are all important influencing factors.

At present, the POS renewal of the Ruijin community is considered an exemplar in Shanghai. However, over-reliance on the conventional theory may mislead the practices under dynamic social change. Our study found that the effectiveness of the current POS renewal in the Ruijin community was limited at the social level. First of all, we believe that the local government should pay more attention to the comprehensive nodes and intermediary nodes in the next phase. It is vital to accurately investigate residents' everyday activities in the core nodes when conducting space renovation to create high-quality, age-friendly, and gender-equal spaces [58,59]. Propaganda linked to community co-governance should also preferentially be performed at these nodes [60]. Second, due to the close relationship between intermediary core POS nodes and core public services, such as schools, hospitals, and food markets, more human-centred consideration should be given to students and parents, doctors and patients, food buyers, and sellers regarding the facility configuration and spatial transformation. For peripheral and inefficient nodes, local governments or developers should guide the public, especially the primary users of POSs, to jointly design, use and maintain spaces, expanding the breadth and depth of public participation, and collaborative governance [20,28]. Moreover, according to residents' initiatives, they should be supported and encouraged to undertake space renewals [61]. Their voice and decision-making rights should also be guaranteed to the greatest extent possible instead of tokenistic participation [62].

## 6. Conclusions

Rapid urban development and community transformation require more reliable and efficient methods to assist urban planners and decision-makers in assessing the renewal of POS. Our research extended the application of SNA method and provided a new idea and quantitative evaluation method to community regeneration. We classified and dissected the role and inter-connection of POSs in residents' everyday lives, based on a comparison of spatial network and behaviour network, using six indicators such as network density, centralities, and core-periphery structure. Our research critically reflected on the current common model of community POS renewal in China. Our results highlighted the necessity to pay particular attention to POS characteristics, functions, and connections with other vital public facilities in the residents' behavioural network. We suggest that the future renewal needs to enhance the social effects of the entire POS structure by improving the quality of core nodes based on the role of nodes in the network to accurately match residents' needs. Furthermore, the voice and decision-making rights of the main user groups in co-governance should be expanded and guaranteed, to ensure the sustainability of projects.

However, there were still some shortcomings of this research that could be improved. Firstly, our data collection was based on paper questionnaires from field surveys. The next step can be to use the community intelligent network platform or rely on the government to organise residents to carry out larger-scale track surveys to expand the sample size and validate the results. Secondly, the evaluation model used the natural breakpoint method to compare the relative strengths of the two types of centralities to obtain the main roles of the nodes in the network which still need to explore the motivation and selection mechanism behind residents' choice of POS to assign more accurate node classification criteria and renewal priority settings. Furthermore, the future work can be combined with

the evaluation at spatial level to discuss the potential influence mechanisms between the two networks, and assess the effectiveness more comprehensively.

**Author Contributions:** Conceptualisation, Y.C. and X.T.; methodology, Y.C.; software, Y.C.; validation, Y.C.; formal analysis, Y.C.; investigation, Y.C.; resources, Y.C.; data curation, Y.C.; writing—original draft preparation, Y.C.; writing—review and editing, Y.C.; visualisation, Y.C.; supervision, X.T.; funding acquisition, X.T. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was funded by the National Social Science Fund of China, grant number 20BGL215.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Not applicable.

**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A

All abbreviations that have been mentioned in this paper are listed here.

**Table A1.** Abbreviations of relevant terms in the paper.

| Abbreviations | |
|---|---|
| *BC* | Betweenness Centrality |
| *CC* | Clustering Coefficient |
| *CS* | Core–periphery Structure |
| *DC* | Degree Centrality |
| *LS* | Link Strength |
| *ND* | Network Density |
| SNA | Social Network Analysis |
| POS | Public open space |
| POSPD | Public open space in a private development |

## References

1. Chen, F.; Li, X. Two Spaces of Contemporary Communities: Geography and Social Network. *Social* **2008**, *5*, 41–57.
2. Wellman, B.; Wortley, S. Different Strokes from Different Folks: Community Ties and Social Support. *Am. J. Sociol.* **1990**, *96*, 558–588. [CrossRef]
3. Lin, N.; Ensel, W.M.; Vaughn, J.C. Social Resources and Strength of Ties: Structural Factors in Occupational Status Attainment. *Am. Sociol. Rev.* **1981**, *46*, 393. [CrossRef]
4. Granovetter, M.S. The Strength of Weak Ties. *Am. J. Sociol.* **1973**, *78*, 1360–1380. [CrossRef]
5. Lin, N. Inequality in Social Capital. *Contemp. Sociol.* **2000**, *29*, 785. [CrossRef]
6. Lin, N. Social Networks and Status Attainment. *Annu. Rev. Sociol.* **1999**, *25*, 467–487. [CrossRef]
7. Lynch, K. *Good City Form*; MIT Press: Cambridge, UK, 1984.
8. Zhu, W.; Wang, J.; Qin, B. Quantity or quality? Exploring the association between public open space and mental health in urban China. *Landsc. Urban Plan.* **2021**, *213*, 104128. [CrossRef]
9. Lai, L.W.; Ho, D.C.; Chau, K.; Yu, E.Y.; Lam, C.L.; Leung, N.T.; Davies, S.N. Property rights & the perceived health contribution of public open space in Hong Kong. *Land Use Policy* **2021**, *107*, 105496. [CrossRef]
10. Jian, I.Y.; Luo, J.; Chan, E.H. Spatial justice in public open space planning: Accessibility and inclusivity. *Habitat Int.* **2020**, *97*, 102122. [CrossRef]
11. Villanueva, K.; Badland, H.; Hooper, P.; Koohsari, M.J.; Mavoa, S.; Davern, M.; Roberts, R.; Goldfeld, S.; Giles-Corti, B. Developing indicators of public open space to promote health and wellbeing in communities. *Appl. Geogr.* **2015**, *57*, 112–119. [CrossRef]
12. Ho, D.C.; Lai, L.W.; Wang, A. The effects of 'publicness' and quality of publicly accessible open space upon user satisfaction. *Environ. Plan. B Urban Anal. City Sci.* **2020**, *48*, 861–879. [CrossRef]
13. Maruani, T.; Amit-Cohen, I. Open space planning models: A review of approaches and methods. *Landsc. Urban Plan.* **2007**, *81*, 1–13. [CrossRef]
14. Mowen, A.J.; Rung, A.L. Park-based social capital: Are there variations across visitors with different socio-demographic characteristics and behaviours? *Leisure/Loisir* **2016**, *40*, 297–324. [CrossRef]

15. Giles-Corti, B.; Vernez-Moudon, A.; Reis, R.; Turrell, G.; Dannenberg, A.L.; Badland, H.; Foster, S.; Lowe, M.; Sallis, J.F.; Stevenson, M.; et al. City planning and population health: A global challenge. *Lancet* **2016**, *388*, 2912–2924. [CrossRef]
16. Paul, A.; Nath, T.K.; Noon, S.J.; Islam, M.M.; Lechner, A.M. Public Open space, Green exercise and wellbeing in Chittagong, Bangladesh. *Urban For. Urban Green.* **2020**, *55*, 126825. [CrossRef]
17. Koohsari, M.J.; Badland, H.; Mavoa, S.; Villanueva, K.; Francis, J.; Hooper, P.; Owen, N.; Giles-Corti, B. Are public open space attributes associated with walking and depression? *Cities* **2018**, *74*, 119–125. [CrossRef]
18. Lamb, K.E.; Mavoa, S.; Coffee, N.; Parker, K.; Richardson, E.A.; Thornton, L. Public open space exposure measures in Australian health research: A critical review of the literature. *Geogr. Res.* **2019**, *57*, 67–83. [CrossRef]
19. Weng, M.; Ding, N.; Li, J.; Jin, X.F.; Xiao, H.; He, Z.M.; Su, S.L. The 15-min walkable neighborhoods: Measurement, social inequalities and implications for building healthy communities in urban China. *J. Transp. Health* **2019**, *13*, 259–273. [CrossRef]
20. Guo, Y.; Liu, Y.; Lu, S.; Chan, O.F.; Chui, C.H.K.; Lum, T.Y.S. Objective and perceived built environment, sense of community, and mental wellbeing in older adults in Hong Kong: A multilevel structural equation study. *Landsc. Urban Plan.* **2021**, *209*, 104058. [CrossRef]
21. Wan, C.; Shen, G.Q.; Choi, S. Underlying relationships between public urban green spaces and social cohesion: A systematic literature review. *City Cult. Soc.* **2021**, *24*, 100383. [CrossRef]
22. Pretty, J.; Barton, J.; Bharucha, Z.P.; Bragg, R.; Pencheon, D.; Wood, C.; Depledge, M.H. Improving health and wellbeing independently of GDP: Dividends of greener and prosocial economies. *Int. J. Environ. Health Res.* **2016**, *26*, 11–36. [CrossRef] [PubMed]
23. Mouratidis, K.; Poortinga, W. Built environment, urban vitality and social cohesion: Do vibrant neighborhoods foster strong communities? *Landsc. Urban Plan.* **2020**, *204*, 103951. [CrossRef]
24. Pozoukidou, G.; Chatziyiannaki, Z. 15-Minute City: Decomposing the New Urban Planning Eutopia. *Sustainability* **2021**, *13*, 928. [CrossRef]
25. Moreno, C.; Allam, Z.; Chabaud, D.; Gall, C.; Pratlong, F. Introducing the "15-Minute City": Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities. *Smart Cities* **2021**, *4*, 6. [CrossRef]
26. Yung, E.H.; Conejos, S.; Chan, E.H.W. Public open spaces planning for the elderly: The case of dense urban renewal districts in Hong Kong. *Land Use Policy* **2016**, *59*, 1–11. [CrossRef]
27. Mouratidis, K. Compact city, urban sprawl, and subjective wellbeing. *Cities* **2019**, *92*, 261–272. [CrossRef]
28. Zhang, C.; Li, X. Urban redevelopment as multi-scalar planning and contestation: The case of Enning Road project in Guangzhou, China. *Habitat Int.* **2016**, *56*, 157–165. [CrossRef]
29. Jian, I.Y.; Chan, E.H.; Xu, Y.; Owusu, E.K. Inclusive public open space for all: Spatial justice with health considerations. *Habitat Int.* **2021**, *118*, 102457. [CrossRef]
30. Nasution, A.D.; Zahrah, W. The Space is Not Ours, the Life of Public Open Space in Gated Community in Medan, Indonesia. *Procedia Soc. Behav. Sci.* **2015**, *202*, 144–151. [CrossRef]
31. Tang, B.-S. Is the distribution of public open space in Hong Kong equitable, why not? *Landsc. Urban Plan.* **2017**, *161*, 80–89. [CrossRef]
32. Timperio, A.; Ball, K.; Salmon, J.; Roberts, R.; Crawford, D. Is availability of public open space equitable across areas? *Health Place* **2007**, *13*, 335–340. [CrossRef] [PubMed]
33. Liang, X.; Tian, H.; Li, X.; Huang, J.-L.; Clarke, K.C.; Yao, Y.; Guan, Q.; Hu, G. Modeling the dynamics and walking accessibility of urban open spaces under various policy scenarios. *Landsc. Urban Plan.* **2020**, *207*, 103993. [CrossRef]
34. Høj, S.B.; Paquet, C.; Caron, J.; Daniel, M. Relative 'greenness' and not availability of public open space buffers stressful life events and longitudinal trajectories of psychological distress. *Health Place* **2021**, *68*, 102501. [CrossRef]
35. Zou, S.; Zhang, S.; Zhen, F. Measurement of community daily activity space and influencing factors of vitality based on residents' spatiotemporal behavior: Taking Shazhou and Nanyuan streets in Nanjing as examples. *Prog. Geogr.* **2021**, *40*, 580–596. [CrossRef]
36. Wan, C.; Shen, G.Q.; Choi, S. Eliciting users' preferences and values in urban parks: Evidence from analyzing social media data from Hong Kong. *Urban For. Urban Green.* **2021**, *62*, 127172. [CrossRef]
37. Pasaogullari, N.; Doratli, N. Measuring accessibility and utilization of public spaces in Famagusta. *Cities* **2004**, *21*, 225–232. [CrossRef]
38. Giles-Corti, B.; Broomhall, M.H.; Knuiman, M.; Collins, C.; Douglas, K.; Ng, K.; Lange, A.; Donovan, R.J. Increasing walking: How important is distance to, attractiveness, and size of public open space? *Am. J. Prev. Med.* **2005**, *28* (Suppl. 2), 169–176. [CrossRef]
39. Edwards, N.; Hooper, P.; Trapp, G.S.; Bull, F.; Boruff, B.; Giles-Corti, B. Development of a Public Open Space Desktop Auditing Tool (POSDAT): A remote sensing approach. *Appl. Geogr.* **2013**, *38*, 22–30. [CrossRef]
40. Gehl, J.; Gemzøe, L. *Public Spaces Public Life*; The Danish Architectural Press: Copenhagen, Denmark, 1996; 96p.
41. Sun, X.; Wang, L.; Wang, F.; Soltani, S. Behaviors of seniors and impact of spatial form in small-scale public spaces in Chinese old city zones. *Cities* **2020**, *107*, 102894. [CrossRef]
42. Roy, S.; Bailey, A. Safe in the City? Negotiating safety, public space and the male gaze in Kolkata, India. *Cities* **2021**, *117*, 103321. [CrossRef]
43. Zhai, Y.; Li, D.; Wu, C.; Wu, H. Urban park facility use and intensity of seniors' physical activity—An examination combining accelerometer and GPS tracking. *Landsc. Urban Plan.* **2020**, *205*, 103950. [CrossRef]

44. Ladle, A.; Galpern, P.; Doyle-Baker, P. Measuring the use of green space with urban resource selection functions: An application using smartphone GPS locations. *Landsc. Urban Plan.* **2018**, *179*, 107–115. [CrossRef]
45. Pawlowski, C.S.; Schmidt, T.; Nielsen, J.V.; Troelsen, J.; Schipperijn, J. Will the children use it?—A RE-AIM evaluation of a local public open space intervention involving children from a deprived neighbourhood. *Eval. Program Plan.* **2019**, *77*, 101706. [CrossRef] [PubMed]
46. Wellman, B.; Berkowitz, S.D. *Social Structures: A Network Approach*; Cambridge University Press: Cambridge, UK, 1989; Volume 94, pp. 1512–1514.
47. Otte, E. Social network analysis: A powerful strategy, also for the information sciences. *J. Inf. Sci.* **2002**, *28*, 441–454. [CrossRef]
48. Eubank, S.; Guclu, H.; Kumar, V.S.A.; Marathe, M.V.; Srinivasan, A.; Toroczkai, Z.; Wang, N. Modelling disease outbreaks in realistic urban social networks. *Nature* **2004**, *429*, 180–184. [CrossRef]
49. Jiang, B.; Claramunt, C. Topological Analysis of Urban Street Networks. *Environ. Plan. B Plan. Des.* **2004**, *31*, 151–162. [CrossRef]
50. Wu, S.-S.; Zhuang, Y.; Chen, J.; Wang, W.; Bai, Y.; Lo, S.-M. Rethinking bus-to-metro accessibility in new town development: Case studies in Shanghai. *Cities* **2019**, *94*, 211–224. [CrossRef]
51. Lee, S.-H.; Choi, J.-Y.; Yoo, S.-H.; Oh, Y.-G. Evaluating spatial centrality for integrated tourism management in rural areas using GIS and network analysis. *Tour. Manag.* **2013**, *34*, 14–24. [CrossRef]
52. Chen, Y.; Lei, X.; Feng, T. Evaluation of community renewal based on social network theory: Taking gucun in baoshan district, shanghai as an example. *City Plan. Rev.* **2021**, *45*, 109–116.
53. Zhong, X.; Chen, X. Demolition, Rehabilitation, and Conservation: Heritage in Shanghai's Urban Regeneration, 1990–2015. *J. Archit. Urban.* **2017**, *41*, 82–91. [CrossRef]
54. Niu, S.; Tang, X. Research on the Equity Measurement of Park Green Space Distribution in High-density Urban Areas—A Case Study of Huangpu District, Shanghai. *Chin. Landsc. Archit.* **2021**, *37*, 100–105.
55. Wu, H.; Wang, L.; Zhang, Z.; Gao, J. Analysis and optimization of 15-min community life circle based on supply and demand matching: A case study of Shanghai. *PLoS ONE* **2021**, *16*, e0256904.
56. L'Aoustet, O.; Griffet, J. Sharing Public Space: Youth Experience and Socialization in Marseille's Borely Park. *Space Cult.* **2004**, *7*, 173–187. [CrossRef]
57. Lak, A.; Aghamolaei, R.; Baradaran, H.R.; Myint, P.K. A Framework for Elder-Friendly Public Open Spaces from the Iranian Older Adults' perspectives: A Mixed-Method Study. *Urban For. Urban Green.* **2020**, *56*, 126857. [CrossRef]
58. Van Hoof, J.; Marston, H.; Kazak, J.; Buffel, T. Ten questions concerning age-friendly cities and communities and the built environment. *Build. Environ.* **2021**, *199*, 107922. [CrossRef]
59. Chen, Y.; Liu, T.; Liu, W. Increasing the use of large-scale public open spaces: A case study of the North Central Axis Square in Shenzhen, China. *Habitat Int.* **2016**, *53*, 66–77. [CrossRef]
60. White, M.P.; Pahl, S.; Wheeler, B.; Depledge, M.H.; Fleming, L.E. Natural environments and subjective wellbeing: Different types of exposure are associated with different aspects of wellbeing. *Health Place* **2017**, *45*, 77–84. [CrossRef]
61. Kou, H.; Zhang, S.; Liu, Y. Community-Engaged Research for the Promotion of Healthy Urban Environments: A Case Study of Community Garden Initiative in Shanghai, China. *Int. J. Environ. Res. Public Health* **2019**, *16*, 4145. [CrossRef]
62. Wang, M.; Zhang, F.; Wu, F. Governing urban redevelopment: A case study of Yongqingfang in Guangzhou, China. *Cities* **2021**, *120*, 103420. [CrossRef]