

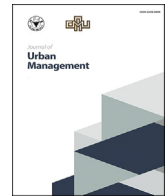
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Research Article

Socio-spatial features of neighbourhoods supporting social interaction between locals and migrants in peri-urban China[☆]Linyan Dai^{a,*}, Xin Sheng^b, Rangan Gupta^c^a Department of Landscape Architecture, University of Sheffield, UK^b Lord Ashcroft International Business School, Anglia Ruskin University, Chelmsford, UK^c Department of Economics, University of Pretoria, Private Bag X20, Hatfield 0028, South Africa

ARTICLE INFO

Keywords:

Socio-spatial features
Social interaction
Locals
Migrants
peri-Urban China

ABSTRACT

Western literature shows evidence of a positive relationship between socio-spatial features of neighbourhoods and social interaction. However, there is little research exploring this relationship in the Chinese context, particularly between locals and migrants in peri-urban China where significant housing is being created. This paper studies the socio-spatial features of neighbourhoods in supporting social interaction between locals and migrants across different neighbourhood types in the peri-urban areas in Guangzhou. In this research, data were collected using door-to-door questionnaires and site surveys in 9 peri-urban neighbourhoods in Guangzhou. The nature and strength of relationships between socio-spatial features of neighbourhoods and social interaction were examined through statistical analysis. The results of this study suggest that the level of maintenance and accessibility can help improve social interaction for locals and migrants living together in villages, redeveloped villages, and commodity housing. Neighbourhood boundaries and quality of neighbourhoods were found to be positively related to social interaction for locals and migrants in redeveloped villages only. In addition, the perceived character of the neighbourhood can positively impact social interaction for locals in villages only. This study demonstrates that high-quality neighbourhoods can improve social interaction between migrants and locals in peri-urban villages, commodity housing, and redeveloped villages in China. The study provides a guide for neighbourhood designers, urban planners, and property managers in peri-urban China regarding how to create a neighbourhood supporting social interaction between locals and migrants in villages, redeveloped villages and commodity housing respectively.

1. Introduction

Social interaction can take place in any physical place, and the arrangement of physical places can manipulate social interaction among people by creating potential social activities and communication (Fainstein, 2005; Howley et al., 2015; Roberts, 2015; Zhu, 2015). There are existing theories and literature suggesting that the quality of public spaces has positive impacts on residents' social activity (Amin et al., 2023). High-quality public spaces can increase residents' sense of safety, sense of community and social interaction, as well as can adhere to shared values “where ethnically and culturally diverse groups can co-exist peacefully” (Mulgan et al., 2006). In China, there are some studies on the impacts of the neighbourhood on social interaction in urban areas. However, very few studies

[☆] We would like to thank two anonymous referees for many helpful comments. However, any remaining errors are solely ours.

* Corresponding author.

E-mail addresses: angeladai2021@hotmail.com (L. Dai), xin.sheng@anglia.ac.uk (X. Sheng), rangan.gupta@up.ac.za (R. Gupta).

<https://doi.org/10.1016/j.jum.2024.07.006>

Received 31 January 2024; Received in revised form 13 July 2024; Accepted 17 July 2024

Available online 12 August 2024

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Table 1
Indicators measuring socio-spatial features of the neighbourhood.

Socio-spatial features	Indicators measuring socio-spatial features
Maintenance	Assessments of pavement condition per street Assessments of litter per street Assessments of facilities
Mixed land use	Assessment of the condition of other homes Number of key facilities per neighbourhood Average number of key facilities per hectare Ratios of residential to non-residential land
Accessibility	Accessibility of bus Accessibility of open spaces Accessibility of facilities/services Residents' perceptions of accessibility
The perceived character	Residents' assessment of the character of the neighbourhood
Natural surveillance	Proportion of active building frontage per street Residents' assessment of natural surveillance
Connectedness and permeability	Number of junctions in each neighbourhood Number of junctions per hectare
Attractiveness	Proportion of open spaces Residents' assessment of attractiveness
Residential density	Per capita area in the neighbourhood and residential area Occupied area of each household in the neighbourhood and residential area Number of persons per household Ratios of residential land to open space per hectare
Legibility	The residential intensity of streets Number of landmarks per hectare Number of nodes per hectare Rating of nodes Residents' assessment of legibility
Physical boundary	Residents' assessment of physical boundaries
The overall measure of quality	Residents' assessment of the quality of neighbourhoods



Fig. 1. Villages (Shengzhou Village, Yuexi Village and Changtan Village) (Source: authors).



Fig. 2. Redeveloped villages (Yufengxincun, Nanronghuayuan and Haiyuyuan) (Source: authors).

addressed the associations between socio-spatial features of the neighbourhood and social interaction in China's peri-urban areas. In the peri-urban areas in China, there are substantial differences between locals and migrants, which can result in clashes between these two groups (Qian et al., 2012), such as the prejudicial attitude of local people toward migrant people (Wang et al., 2015). The influx of migrants to large cities has urged the Chinese government to pay attention to social interaction between locals and migrants, in particular the peri-urban areas in China, pointing to a need to explore social interaction between locals and migrants in various neighbourhood types in peri-urban China.

This paper focuses on the impact of socio-spatial features of the quality of the neighbourhood on social interaction between locals and migrants in the selected nine neighbourhoods in Panyu District, Guangzhou, China. This study makes distinct contributions. In the existing literature, there is very little research on how social interaction may occur between locals and migrants. This paper contributes to sociological research by examining social interaction based on two groups of residents (locals and migrants). Moreover, this paper provides the extent and nature of the associations between socio-spatial features of quality of the neighbourhood and social interaction for locals and migrants in villages, redeveloped villages, and commodity housing. In addition, there is no consensus about indicators of social interaction and indicators measuring socio-spatial features of the quality at the neighbourhood level both in political rhetoric and academic research, this paper contributes to sociological research by defining indicators of social interaction and indicators measuring socio-spatial features of the quality at the neighbourhood level within the Chinese context. Last but not least, this paper makes suggestions to neighbourhood planners, designers and property managers in peri-urban areas in China regarding how to create a neighbourhood supporting social interaction between locals and migrants in villages, redeveloped villages, and commodity housing, respectively.

The remainder of this paper is organized as follows: In Section 2, we contextualize our study in terms of the general relationship between locals and migrants in China, before discussing in Section 3 the existing international and domestic literature on socio-spatial features on social interaction, along with the underlying definition of social interaction. Our methodological approach is outlined in Section 4, and results are presented in Section 5, with Section 6 concluding the paper.

2. Relationship between locals and migrants in China

Beginning in the 1980s, thousands of rural migrants (farmers-turned-workers) moved from rural to urban areas to improve their lives in China (Li & Li, 2007). The influx of these rural migrants into urban areas reached about 230 million people by 2012 (Wang & Fan, 2012). Rural migrants usually earn lower incomes, have lower education than locals, may communicate in different dialects, and cannot speak the main dialect of Mandarin fluently (Jacka, 2014). As a consequence, they often take on the least appealing jobs to urban residents (Knight and Gunatilaka, 2010). These jobs can be physically exhausting, with a poor working environment and few welfare benefits, and have low status and low income (Jacka, 2014). Moreover, the hukou (household registration) system in China is still in effect. Under the household registration system, everyone is officially registered as either an urban or a rural resident. Urban residents holding the urban hukou and rural migrants registered with the rural hukou receive differential institutional treatment regarding the provision of public services and goods. For example, rural migrants are given restricted rights in cities compared with residents registered with urban hukou, such as social security, admission for their children to urban schools, employment resources, and housing benefits (Tse, 2016). It is difficult for rural migrants to obtain urban hukou. For example, holding urban hukou is frequently a prerequisite for buying urban properties. Most migrants work in cities for a period of time, then return to their rural areas, or they work in urban areas seasonally (Li et al., 2006). Alongside rural migrants, a number of migrants from small-medium-sized cities have also moved to larger Chinese cities in recent decades (Wei & Gao, 2016). So far, there are three types of migrants in Chinese cities, which include rural-to-urban migrants, who are the majority of Chinese large cities migrants to, in particular, the peri-urban areas; urban-to-urban migrants; and university graduates who moved from their birthplaces (Wei & Gao, 2016).

Migrants' social integration has become a key challenge for Chinese cities because rural migrants face discrimination from urban locals (Wang et al., 2017). Numerous studies discuss urban residents' discrimination against rural migrants in China due to various aspects, particularly hukou-based social exclusion and language prejudices (Wong et al., 2008). For example, Tse (2016) explores the factors shaping urban residents' prejudice toward rural migrants and the influences of prejudice on rural migrants' integration into urban neighbourhoods. The findings indicate that urban residents with higher household incomes and higher education are more prejudiced toward rural migrants than other urban residents. This study also suggests that urban residents holding urban hukou at birth report stronger prejudice. Kuang and Liu (2012) argue that the hukou system is found to lead to inequalities in social status between rural and urban residents, discrimination against rural migrants and social segregation between rural and urban residents within Chinese cities (Zhao & Wang, 2018). Cantonese is the native language spoken among locals in Guangzhou, Guangdong Province (Qian et al., 2012). However, most migrants cannot speak Cantonese, even Mandarin, meaning that there may be difficulties in communicating with locals in Guangzhou or being understood. Furthermore, other studies show the influence of discriminatory experiences and perceived social inequity on mental health among rural migrants. For instance, Lin et al. (2011) indicate that reducing public discrimination against rural migrants and eliminating structural barriers (like the hukou system) could improve rural migrants' psychological well-being. Wang et al. (2010) find that urban residents' discrimination against rural migrants can have a negative effect on rural migrants' quality of life and psychological distress.

In conclusion, even though migrants play a crucial role in the economic growth and industrial development of Chinese large cities, their contribution may often be ignored. They are subject to discrimination from locals and excluded from the provision of public services. In addition, although recent hukou reforms in small cities enable rural migrants to register as urban residents and to obtain all social benefits, almost all large cities experience negligible influences of hukou reforms due to concerns that increasing the influx of migrants may decrease the level of services provided (Wu & Wang, 2014). Therefore, it is likely that locals' discrimination against rural



Fig. 3. Commodity housing (Baifuyuan, Lianhuawanpan and Fuyiyuansiqu) (Source: authors).

Table 2

The proportion and number of questionnaires completed by migrants and locals.

Neighbourhood types	Neighbourhood name	Percentage of locals (%)	Percentage of migrants (%)	Total
Commodity housing	Fuyiyuansiqu	46.7	53.3	105
	Lianhuawanpan	44.2	55.8	104
	Baifuyuan	50.5	49.5	97
Redeveloped villages	Yufengxincun	46.2	53.8	132
	Nanronghuayuan	54.2	45.8	96
	Haiyuyuan	57.6	42.4	92
Villages	Yuexi Village	47.3	52.7	186
	Changtan Village	46.3	53.7	175
	Shengzhou Village	59.7	40.3	129

migrants will continue for a long time in China, and could manifest itself as problematic in peri-urban neighbourhoods and negatively affect social interactions and networks between locals and migrants. This highlights the urgent need for studies on social interaction between locals and migrants.

3. Social interaction and socio-spatial features of the neighbourhood

3.1. Defining social interaction

Social interaction is defined at the micro level as a situation where the behaviours of one individual are consciously recognised by, and influence the behaviours of, another individual, and vice versa (Turner, 1988). It is the process of reciprocal influence exercised by individuals over social encounters (Little, 2016) and is the basic process of formatting both social order and human nature (Wirth, 1964). Social interaction is considered a key aspect of creating a sustainable and liveable city (Lloyd et al., 2016). The opportunities for social interaction not only have a positive influence on residents' physical and psychological aspects but also create a sense of belonging and foster a sense of community for residents in the neighbourhood (Riger & Lavrakas, 1981; Kearns & Parkinson, 2001; Zhang et al., 2018).

There are a large number of studies measuring social interaction in the global literature, including China. There are two types of social interaction, including positive social interaction and negative social interaction (Krause, 2006). Positive social interaction may include the number of friends people have (Shirazi et al., 2022; Zhang et al., 2018), the number of people known by name in the neighbourhood (Can & Heath, 2016; Zhang et al., 2018; Shirazi et al., 2022), the number of neighbours people wave and say hello to (Can & Heath, 2016). Negative interactions may include avoidance, annoyance, and disturbance (Ebbesen et al., 1976; Skjaeveland et al., 1996). Forrest and Kearns (2001) argue that negative social interaction may positively affect social cohesion in a neighbourhood (Muhuri & Basu, 2018). Social cohesion can be impacted by the quality of the neighbourhood, so negative social interaction may also be influenced by the socio-spatial features of the neighbourhood. Therefore, both positive and negative social interactions are used to measure social interaction in this research.

Social interaction is measured mainly using respondents' answers regarding social interaction (Van den Berg et al., 2017). There are a large number of examples of indicators measuring social interaction in social science research. In this research, social interaction is measured by using both positive and negative indicators. These indicators measuring social interaction between locals and migrants include the number of your neighbours you would have a chat with (chat), the number of your neighbours you would ask to borrow food/tools from (borrow), the number of your neighbours you would know by name (know), the number of your neighbours you would avoid contact with (avoid).

3.2. The effects of the quality of the neighbourhood on social interaction

Socio-spatial features of the neighbourhood are found to have an impact on social interaction in global literature (Forrest & Yip,

Table 3
Correlations between accessibility and social interaction for locals and migrants.

Indicators of accessibility	Villages				Redeveloped villages				Commodity housing			
	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid
Provision of open spaces (Household survey)	0.137*		0.214**					0.298**		0.148*		0.128*
Provision of toilet (Household survey)												
Number of bus stops (Site survey)				0.138*								
Number of buses per hour (Site survey)				-0.167**								
I can easily reach public transport services on foot (Household survey)												
Public transport is frequent and reliable (Household survey)												
Public transport goes when and where I want it to go (household survey)				0.161**								
Number of open spaces per hectare (Site survey)			0.128*									-0.137*
Provision of shop (Household survey)			0.119*									
Provision of recreation (Household survey)	0.120*		0.149**	0.151**								
Provision of parking (Household survey)	0.165**		0.114*	0.168**								
Opportunities of sport (Household survey)	0.113*		0.133*	0.111*								
Opportunities of exercise (Household survey)				0.131*								
Opportunities of recreation (Household survey)			0.118*				-0.145*					
Opportunities of walking the dog (Household survey)												-0.124*
Opportunities of being in a natural environment (Household survey)									0.176**			
Opportunities of taking children to play (Household survey)									0.128*			

Note: * and ** represent the results that are statistically significant at the 0.05 and 0.01 level, respectively.

Table 4
Correlations between accessibility and social interaction for locals.

Indicators of accessibility	Villages				Redeveloped villages				Commodity housing			
	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid
Provision of open spaces (Household survey)			0.182*									
Provision of toilet (Household survey)												
Number of bus stops (Site survey)												
Number of buses per hour (Site survey)												
I can easily reach public transport services on foot (Household survey)												
Public transport is frequent and reliable (Household survey)			0.230**	−0.176*								
Public transport goes when and where I want it to go (household survey)												
Number of open spaces per hectare (Site survey)						−0.200*		0.394**				
Provision of shop (Household survey)							0.223**	0.238*				
Provision of recreation (Household survey)			0.172*									−0.196*
Provision of parking (Household survey)			0.212**	−0.212**								
Opportunities of sport (Household survey)	0.156*		0.207**					0.307**				
Opportunities of exercise (Household survey)	0.177*											
Opportunities of recreation (Household survey)												
Opportunities of walking the dog (Household survey)								0.222*				
Opportunities of being in a natural environment (Household survey)										0.227**		
Opportunities of taking children to play (Household survey)										0.247**		

Note: * and ** represent the results that are statistically significant at the 0.05 and 0.01 level, respectively.

Table 5
Correlations between accessibility and social interaction for migrants.

Indicators of accessibility	Villages				Redeveloped villages				Commodity housing			
	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid
Provision of open spaces (Household survey)	0.248**		0.244**							0.181*		-0.176*
Provision of toilet (Household survey)	0.247**		0.186*									
Number of bus stops (Site survey)												
Number of buses per hour (Site survey)	0.203**											
I can easily reach public transport services on foot (Household survey)												
Public transport is frequent and reliable (Household survey)				-0.192*								
Public transport goes when and where I want it to go (household survey)												
Number of open spaces per hectare (Site survey)												0.179*
Provision of shop (Household survey)												
Provision of recreation (Household survey)												
Provision of parking (Household survey)												
Opportunities of sport (Household survey)				0.203**						0.188*		
Opportunities of exercise (Household survey)				0.265**								
Opportunities of recreation (Household survey)			0.178*	0.228**								
Opportunities of walking the dog (Household survey)			0.180*	0.220**								
Opportunities of being in a natural environment (Household survey)												
Opportunities of taking children to play (Household survey)			0.184*			0.196*						

Note: * and ** represent the results that are statistically significant at the 0.05 and 0.01 level, respectively.

2007; Kaźmierczak, 2013; Nutsford et al., 2013; Shirazi et al., 2022). The presence of green spaces has a positive influence on social interaction in a neighbourhood (Maas et al., 2009; Sugiyama et al., 2008). Neighbourhood open spaces (in particular green spaces) can provide opportunities for residents' social interaction by helping residents develop social ties (Kaźmierczak, 2013). Diverse recreational facilities can also encourage residents' visits and increase their social interaction (Gehl, 2011; Huang, 2006). Moreover, spatial patterns with higher connectivity and integration can increase residents' social interaction (Nooraddin, 2002). The spaces between buildings and streets are an extension of buildings' interior spaces. These spaces (such as sidewalks and cafes) encourage people's street life and social encounters in a city (Can & Heath, 2016).

In Chinese literature, scholarly interest in the impacts of the quality of a neighbourhood on social interaction has grown considerably in urban areas. For example, Wang et al. (2016) examine the intergroup social interaction between migrants and locals living in various spatial contexts in Nanjing. They suggest that a neighbourhood with low-storey housing has more social interactions because of the provision of shared places where users have more chances to chat with each other in urban China. Wu and Logan (2016) contrast the neighbourhood socialising of migrants and locals in Beijing. They find that migrant residents are more likely to interact with neighbours, which can help strengthen their sentiment towards the neighbourhood where they live. Forrest and Yip (2007) suggest that socio-spatial features of the quality of the residential environment play a significant role in social interactions among residents. Although neighbourhood social interaction gains significant attention now in China, however, there is little research that addresses the relationship between socio-spatial features of the neighbourhood and local-migrant interactions in China, in particular peri-urban areas.

Therefore, this study examines the effects of socio-spatial features of the quality of neighbourhood on social interaction in Guangzhou, China. In this research, the socio-spatial features of the neighbourhood are primarily relevant at the street level and the neighbourhood level. Socio-spatial features of the neighbourhood are chosen through the sustainability paradigm because green spaces are often related to social sustainability by increasing social interaction. Furthermore, selecting socio-spatial features of the neighbourhood needs to consider policy-making, since the suggestions regarding the socio-spatial features of the neighbourhood for



(caption on next page)

Fig. 4. Correlations between accessibility and social interaction for locals and migrants

Notes: The figure reports colour-coded stacked column charts measuring correlations between indicators of accessibility and social interaction for locals and migrants in villages, developed villages and commodity housing, respectively. The indicators of social interaction include the number of your neighbours you would have a chat with (Chat), the number of your neighbours you would ask to borrow food/tools from (Borrow), the number of your neighbours you would know by name (Know), the number of your neighbours you would avoid contact with (Avoid). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

neighbourhood designers, planners, and managers aim to increase social interaction between locals and migrants in the peri-urban areas in China. According to the existing literature, eleven socio-spatial features of the neighbourhood are selected, which include residential density, maintenance, accessibility, mixed land uses, perceived character, connectedness and permeability, natural surveillance, attractiveness, neighbourhood boundaries, legibility, and residents' perceptions of the quality of neighbourhoods. These socio-spatial features of the neighbourhood are translated into a range of measurable indicators, which are shown in Table 1. Both objective and subjective indicators are used at different scales (such as neighbourhood scale, household level, street scale and individual level) to get comprehensive measures for socio-spatial features of the quality. These indicators are frequently applied in neighbourhood research and practices (Weimann et al., 2017), and can effectively measure features of the neighbourhood (Bryman, 2016).

4. Methodology

In China, there are five large-sized cities: Beijing, Guangzhou, Shenzhen, Tianjin and Shanghai. Guangzhou City is an appropriate area to examine the relationship between social interaction and socio-spatial features of the neighbourhood. Guangzhou City is the capital of Guangdong Province and the third-largest city in China. This city is one of the most attractive cities for migrants in China (Wu et al., 2019). According to the data from the Guangzhou Municipal Government, there are about six million migrants in Guangzhou, accounting for half of the city's whole population. In this research, there are 3 types of neighbourhoods where migrants and locals are housed in the peri-urban areas of Panyu District. So, the three neighbourhood types in the peri-urban context need to be chosen. In this way, three villages, three redeveloped villages, and three commodity housing are chosen, according to housing types, the number of households, the ratio of migrant residents (i.e., a low percentage of migrant residents, 50:50 migrants and locals, and a high percentage of migrants in each neighbourhood), and age of the community. The selected neighbourhoods include i) villages: Changtan Village, Yuexi Village, Shengzhou Village (Fig. 1); ii) redeveloped villages: Haiyuyuan, Nanronghuayuan, Yufengxincun (Fig. 2); and iii) commodity housing: Fuyiyuansiqu, Lianhuawanpan, Baifuyuan (Fig. 3).

Detailed information regarding the characteristics of the study sites and their populations is provided by Dai (2021). Moreover, the physical site survey is used to collect data measuring objective indicators of socio-spatial features of the neighbourhood due to the lack of existing information. The adoption of objective indicators in the site survey is beneficial because most objective indicators of socio-spatial features do not change over many years, such as the quality of pavement and the quality of facilities. This means that the majority of data is likely to stay the same for a few years. The door-to-door questionnaire survey is used to mainly collect data about subjective variables of socio-spatial features of the neighbourhood, dimensions of social interaction, and the socio-economic characteristics of the sample in the nine neighbourhoods. The details regarding the design of the questionnaire survey and the physical site survey to measure objective variables of socio-spatial features of the neighbourhood are shown by Dai (2021). The questionnaires were conducted by the researcher and a team of university students in the nine neighbourhoods over the period of three months in 2016, in Panyu, Guangzhou City. The random sampling approach is applied. A total of 1116 valid questionnaires are collected in this research. The proportion of questionnaires completed by locals and migrants in each neighbourhood is shown in Table 2. The detailed descriptive statistical profile of the sample population is provided by Dai (2021).

With regard to quantitative data, correlation analyses are used to examine the strength and direction of associations between socio-spatial features of the neighbourhood and social interaction. Spearman's correlation is used for the ordinal data and is calculated using the formula: $\rho = \text{Cov}(R(X), R(Y)) / \sigma R(X)\sigma R(Y)$, where $\text{Cov}(R(X), R(Y))$ is the covariance of the rank variables, $\sigma R(X)\sigma R(Y)$ is the product of the standard deviations of the rank variables. The correlation coefficient ρ ranges in values from -1 to $+1$, with the sign $+$ ($-$) indicating a positive (negative) correlation between two variables. The size of ρ indicates the strength of the association between two variables. In terms of qualitative data, content analysis is used, which includes coding, counting phenomena, and contrasting and comparing relationships between variables (Bryman, 2016). Content analysis can reduce the researcher's personal biases (Bryman, 2016).

5. Results

The results of this research are provided in the following tables and figures. According to the existing literature, these research results are critically discussed in this section.

5.1. Accessible neighbourhoods

The accessibility of the neighbourhood is found to have positive associations with social interaction for the full sample of both locals and migrants, as well as the sub-sample of locals and migrants respectively in villages, redeveloped villages, and commodity housing (Tables 3–5), indicating that residents who describe that their neighbourhood is easily accessible are more likely to interact with their



Fig. 5. Correlations between accessibility and social interaction for locals

Notes: The figure reports colour-coded stacked column charts measuring correlations between indicators of accessibility and social interaction for locals in villages, developed villages and commodity housing, respectively. The indicators of social interaction include the number of your neighbours you would have a chat with (Chat), the number of your neighbours you would ask to borrow food/tools from (Borrow), the number of your neighbours you would know by name (Know), the number of your neighbours you would avoid contact with (Avoid). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)



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Fig. 6. Correlations between accessibility and social interaction for migrants

Notes: The figure reports colour-coded stacked column charts measuring correlations between indicators of accessibility and social interaction for migrants in villages, developed villages and commodity housing, respectively. The indicators of social interaction include the number of your neighbours you would have a chat with (Chat), the number of your neighbours you would ask to borrow food/tools from (Borrow), the number of your neighbours you would know by name (Know), the number of your neighbours you would avoid contact with (Avoid). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Table 6
Correlations between maintenance and social interaction for locals and migrants.

Indicators of maintenance	Villages				Redeveloped villages				Commodity housing			
	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid
Assessment of bus stop (Site survey)	0.137*		0.214**									
Assessment of pavement (Site survey)										0.130*		
Assessment of litter (Site survey)									0.203**			
Quality of facilities (Site survey)	0.130*		0.161**						0.193**	0.148*		
Quality of facilities (Household survey)			0.152**									-0.132*
Assessment of litter (Household survey)												
Assessment of pavement (Household survey)		0.130*		-0.121*								

Note: * and ** represent the results that are statistically significant at the 0.05 and 0.01 level, respectively.

Table 7
Correlations between maintenance and social interaction for locals.

Indicators of maintenance	Villages				Redeveloped villages				Commodity housing			
	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid
Assessment of bus stop (Site survey)			0.182*									
Assessment of pavement (Site survey)												
Assessment of litter (Site survey)								0.310**				
Quality of facilities (Site survey)					0.233*			0.243*				
Quality of facilities (Household survey)			0.197*							0.205*		
Assessment of litter (Household survey)												
Assessment of pavement (Household survey)		0.170*	0.158*							0.174*		

Note: * and ** represent the results that are statistically significant at the 0.05 and 0.01 level, respectively.

Table 8
Correlations between maintenance and social interaction for migrants.

Indicators of maintenance	Villages				Redeveloped villages				Commodity housing			
	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid
Assessment of bus stop (Site survey)	0.248**		0.244**									
Assessment of pavement (Site survey)	-0.203**									0.209*		
Assessment of litter (Site survey)	-0.203**										-0.180*	
Quality of facilities (Site survey)	0.247**		0.186*			0.249*				0.181*		
Quality of facilities (Household survey)		0.225**	0.179*									
Assessment of litter (Household survey)						0.229*						
Assessment of pavement (Household survey)												

Note: * and ** represent the results that are statistically significant at the 0.05 and 0.01 level, respectively.



(caption on next page)

Fig. 7. Correlations between maintenance and social interaction for locals and migrants

Notes: The figure reports colour-coded stacked column charts measuring correlations between indicators of maintenance and social interaction for locals and migrants in villages, developed villages and commodity housing, respectively. The indicators of social interaction include the number of your neighbours you would have a chat with (Chat), the number of your neighbours you would ask to borrow food/tools from (Borrow), the number of your neighbours you would know by name (Know), the number of your neighbours you would avoid contact with (Avoid). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

neighbours in these neighbourhoods. These results support the theory and practice which considers accessibility to be a factor positively associated with social interaction (Tsai, 2014). In villages, the correlation between accessibility and social interaction for locals is weaker than for migrants (Tables 4 and 5). The possible explanation is that the level of accessibility assessed by migrants (0.20) is higher than by locals (0.12) in villages, indicating that migrants are more likely to use facilities and services than locals. Thus, the accessibility of facilities and services may be more important for migrants than for locals in villages. In redeveloped villages, the association between these indicators for locals is stronger than for migrants (Tables 4 and 5). This may be related to residents' economic status. 80% of migrants and just 44% of locals are in full-time employment or are full-time university students, indicating that most locals may spend more time using facilities and services than migrants in their neighbourhood. In commodity housing, there is a weak correlation between these variables for locals and migrants (Tables 4 and 5). 74% of locals and 67% of migrants work or study full-time, which suggests that most locals and migrants may spend less time using facilities in commodity housing.

Fig. 4 shows that the correlations between the indicators of accessibility and social interaction for both locals and migrants in villages are stronger than in redeveloped villages and commodity housing. Moreover, the figure indicates that the indicators of accessibility such as the provision of recreation, the provision of parking, and opportunities for sport are closely associated with social interactions for both locals and migrants in villages. Fig. 5 reveals the correlations between accessibility and social interaction for locals in villages and redeveloped villages are stronger than in community housing. The results indicate that locals in villages and redeveloped villages are more likely to use facilities and services than in commodity housing. Fig. 6 shows that the association between social interaction and the level of accessibility for migrants in villages is the strongest in the three neighbourhood types. This also indicates migrants in villages are more likely to use facilities than in the other two neighbourhood types.

In general, the research shows that the level of accessibility has a significant association with social interaction for locals and migrants in villages, redeveloped villages, and commodity housing. Therefore, this research suggests the design and planning for accessible neighbourhoods can contribute to improving levels of social interaction for locals and migrants in different neighbourhood types in the peri-urban Chinese context.

5.2. Well-maintained neighbourhoods

Existing theory suggests that good maintenance is a socio-spatial feature of a high-quality built environment (Cooper et al., 2014). The results of this research concur and show that maintenance of the neighbourhood has positive and significant associations with social interaction for the full sample of both migrants and locals, as well as the sub-sample of migrants and locals respectively in villages, redeveloped villages and commodity housing (Tables 6–8). The findings indicate that residents who state that the level of maintenance is higher are more likely to interact with their neighbours in these neighbourhoods. These findings are consistent with the theoretical claim that there is a positive relationship between the level of maintenance in a neighbourhood and social interaction (Duchowny et al., 2020). Therefore, this research suggests that providing a well-maintained built environment that can help support positive social interaction between locals and migrants should be meaningful and valid in the three neighbourhood types. Moreover, Figs. 7–9 reveal that the correlation between the level of maintenance and social interaction in the full-sample analysis for locals and migrants, as well as the sub-sample analyses for locals and migrants in commodity housing is the weakest among the three neighbourhood types. This indicates that the impact of the level of maintenance on social interaction in commodity housing is smaller than in the other two neighbourhood types (i.e., villages and redeveloped villages).

5.3. Legible neighbourhoods

According to existing empirical studies, legible spaces can support positive social interaction among users by strengthening their attention, and clarifying their perception and mental awareness towards public places (Ujang, 2012; Yeung, 1996). This claim is supported by the results of this research. The correlation analyses (Table 8) show that there are positive correlations between the extent of legibility and social interaction in the full sample analysis for both locals and migrants in villages, redeveloped villages, and commodity housing. Overall, when the extent of legibility increases, social interaction also increases in villages, redeveloped villages, and commodity housing. Fig. 10 shows that correlations between the extent of legibility and social interaction for both locals and migrants in villages are stronger than in redeveloped villages and commodity housing. This suggests that the impacts of the extent of legibility on social interaction for both locals and migrants in villages are bigger than in the other two neighbourhood types.

Furthermore, Tables 10 and 11 find that a positive correlation exists between these indicators for locals living in villages and redeveloped villages, and for migrants living in villages and commodity housing. Figs. 11 and 12 provide a visual presentation of this finding and highlight the heterogeneity between the locals and migrants in terms of the impact of legibility on social interaction in redeveloped villages and commodity housing. Although the full sample analysis indicates a positive relationship between the level of legibility and social interaction in the two neighbourhood types, the subsample analyses indicate that the positive relationship identified



(caption on next page)

Fig. 8. Correlations between maintenance and social interaction for locals

Notes: The figure reports colour-coded stacked column charts measuring correlations between indicators of maintenance and social interaction for locals in villages, developed villages and commodity housing, respectively. The indicators of social interaction include the number of your neighbours you would have a chat with (Chat), the number of your neighbours you would ask to borrow food/tools from (Borrow), the number of your neighbours you would know by name (Know), the number of your neighbours you would avoid contact with (Avoid). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

in the full sample was mainly driven by the data for the locals in redeveloped villages and for the migrants in commodity housing.

Overall, this research suggests that a legible neighbourhood can increase social interaction between locals and migrants in villages, redeveloped villages, and commodity housing. However, further study is needed to understand the level of legibility completely because the indicators of legibility are just related to the neighbourhood level.

5.4. High-quality neighbourhoods

Existing theory indicates that residents who rate their built environment as a good neighbourhood to live in are more likely to interact with their neighbours (Lloyd et al., 2016). This is supported by the results of this research. This research reveals that a positive correlation exists between the quality of neighbourhoods and social interaction for locals and migrants in redeveloped villages only in the correlation analysis (Tables 9–11), suggesting that locals and migrants rating the quality of their neighbourhood is high are more likely to engage in social interaction in redeveloped villages (Fig. 10). Figs. 11 and 12 reveal that there is a positive association between the quality of neighbourhoods and social interaction for migrants in redeveloped villages only, indicating that the positive relationship identified in the full sample was mainly driven by the data for the migrants. Moreover, no correlations between the quality of neighbourhoods and social interaction are significant for locals and migrants in villages and commodity housing, indicating that other socio-spatial features of neighbourhoods may have a stronger influence on social interaction than the quality of neighbourhoods for locals and migrants in the two neighbourhood types.¹ Therefore, this research recommends that both improving residents' perceived quality and the physical quality of public spaces within a neighbourhood are important to enhance social interaction between locals and migrants in redeveloped villages.

5.5. The importance of boundaries in the neighbourhoods with character

Some existing studies suggest that the existence of neighbourhood boundaries can increase social interaction (Tezel, 2011). The correlation analysis shows that there is a positive correlation between neighbourhood boundaries and social interaction in the full-sample analysis for both locals and migrants and the sub-sample analysis for locals and migrants respectively in redeveloped villages (Tables 9–11). This research suggests that the existence of neighbourhood boundaries is important for improving social interaction between locals and migrants in redeveloped villages. Figs. 10–12 show that a positive correlation exists between neighbourhood boundaries and social interaction for migrants in commodity housing, indicating that the existence of neighbourhood boundaries has an impact on social interaction for migrants only.

The correlation analysis also reveals that the perceived character of the neighbourhood is positively related to social interaction in the full-sample analysis for locals and migrants, as well as the sub-sample analysis for locals in villages only (Tables 8 and 9; Figs. 10–12). This indicates that the positive relationship identified in the full sample was mainly driven by the data for the locals in villages. These results support the theory that residents who rate the perceived character of their neighbourhood as good are more likely to interact with their neighbours (Rasidi et al., 2012). Therefore, this research suggests that a neighbourhood with character can increase social interaction in villages.

6. Conclusions

This paper investigates the socio-spatial features of neighbourhoods in supporting social interaction between migrants and locals across different neighbourhood types in peri-urban China. The findings of this research suggest that socio-spatial features of neighbourhoods do contribute to social interaction between locals and migrants in villages, redeveloped villages, and commodity housing, but the nature and strength of associations are different between different socio-spatial features of the neighbourhood in these neighbourhoods. These results are supported by the existing literature that the socio-spatial features of neighbourhoods positively impact residents' social interaction (Howley et al., 2015; Roberts, 2015).

The main results of this paper show that socio-spatial features of the neighbourhood such as the levels of legibility, accessibility, maintenance, boundaries, and perceived quality and character of neighbourhoods are positively and statistically significantly associated with social interaction between migrants and locals across different neighbourhood types in peri-urban China. The results suggest that the level of maintenance and accessibility can help improve social interaction for locals and migrants living together in villages, redeveloped villages, and commodity housing. The quality of neighbourhoods is found to be positively related to social interaction for locals and migrants in redeveloped villages only. There is an association between neighbourhood boundaries and social interaction for

¹ For future studies, it is recommended that the study further explores what these characteristics might be and how they are related to social dynamics. Besides, in-depth interviews from residents would offer deeper insights into the factors at play.



Fig. 9. Correlations between maintenance and social interaction for migrants

Notes: The figure reports colour-coded stacked column charts measuring correlations between indicators of maintenance and social interaction for migrants in villages, developed villages and commodity housing, respectively. The indicators of social interaction include the number of your neighbours you would have a chat with (Chat), the number of your neighbours you would ask to borrow food/tools from (Borrow), the number of your neighbours you would know by name (Know), the number of your neighbours you would avoid contact with (Avoid). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

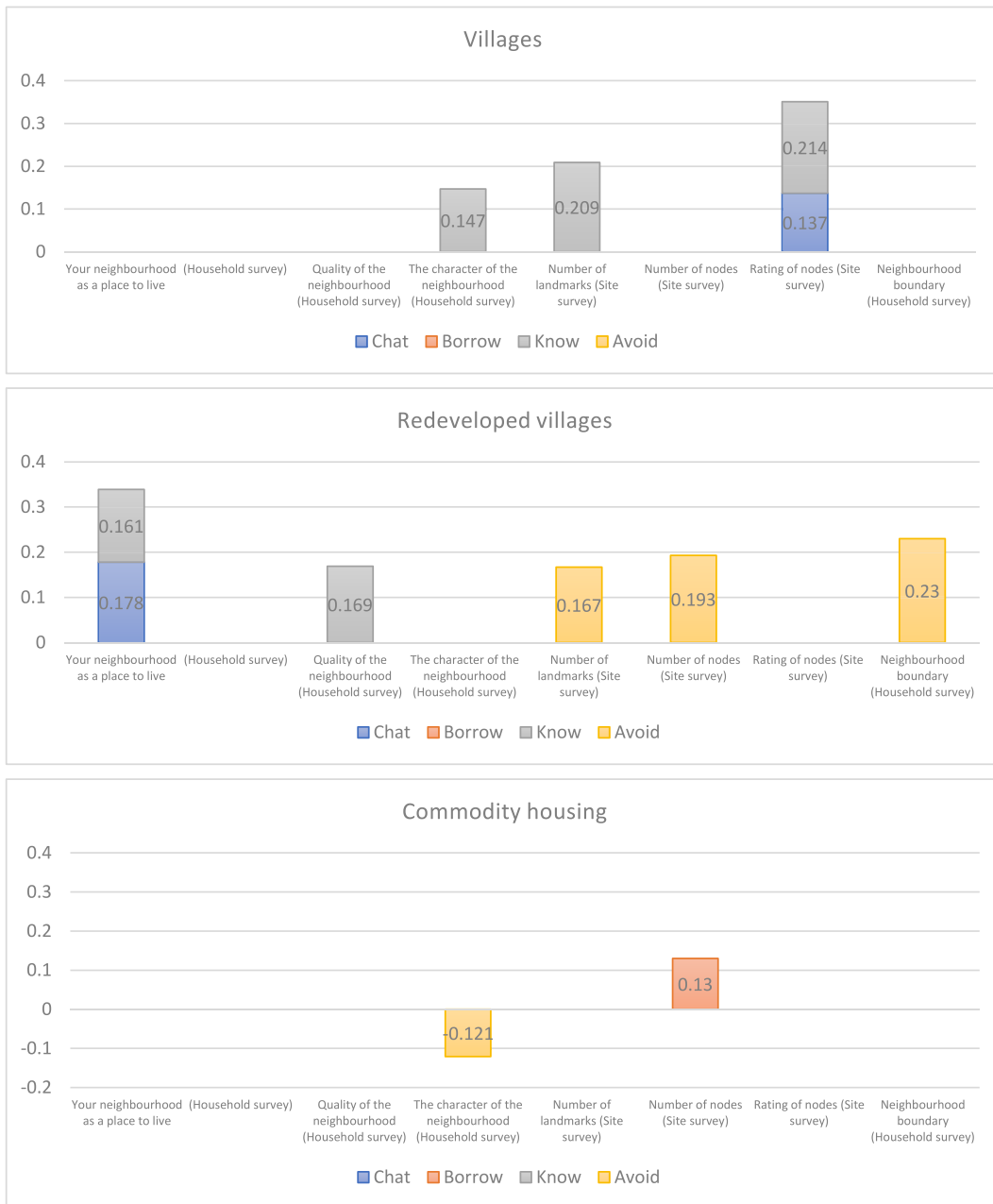


Fig. 10. Correlations between other socio-spatial features of neighbourhoods and social interaction for locals and migrants
 Notes: The figure reports colour-coded stacked column charts measuring correlations between other socio-spatial features of neighbourhoods and indicators of social interaction for locals and migrants in villages, developed villages and commodity housing, respectively. The indicators of social interaction include the number of your neighbours you would have a chat with (Chat), the number of your neighbours you would ask to borrow food/tools from (Borrow), the number of your neighbours you would know by name (Know), the number of your neighbours you would avoid contact with (Avoid). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

both locals and migrants in redeveloped villages and for migrants in commodity housing. In addition, the perceived character of the neighbourhood can positively impact social interaction for locals in villages only. This study demonstrates that high-quality neighbourhoods can improve social interaction between migrants and locals in peri-urban villages, commodity housing, and redeveloped villages in China.

The study provides a guide for neighbourhood designers, urban planners, and property managers in peri-urban China regarding how to create a neighbourhood supporting social interaction between locals and migrants in villages, redeveloped villages, and commodity housing respectively. However, it is noteworthy that this research is based on a small number of neighbourhoods located in Guangzhou



Fig. 11. Correlations between other socio-spatial features of neighbourhoods and social interaction for locals
 Notes: The figure reports colour-coded stacked column charts measuring correlations between other socio-spatial features of neighbourhoods and indicators of social interaction for locals in villages, developed villages and commodity housing, respectively. The indicators of social interaction include the number of your neighbours you would have a chat with (Chat), the number of your neighbours you would ask to borrow/tools from (Borrow), the number of your neighbours you would know by name (Know), the number of your neighbours you would avoid contact with (Avoid). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

City. For future research, a larger number of neighbourhoods can be extended to explore their relationships with social interaction. Furthermore, the research is only conducted in the peri-urban areas in Guangzhou City. More studies can be carried out in urban areas of other cities in China. Moreover, there can be other impacts on social interaction alongside the quality of the neighbourhood, such as



Fig. 12. Correlations between other socio-spatial features of neighbourhoods and social interaction for migrants
 Notes: The figure reports colour-coded stacked column charts measuring correlations between other socio-spatial features of neighbourhoods and indicators of social interaction for migrants in villages, developed villages and commodity housing, respectively. The indicators of social interaction include the number of your neighbours you would have a chat with (Chat), the number of your neighbours you would ask to borrow food/tools from (Borrow), the number of your neighbours you would know by name (Know), the number of your neighbours you would avoid contact with (Avoid). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Table 9

Correlations between other socio-spatial features of neighbourhoods and social interaction for locals and migrants.

Other socio-spatial features	Villages				Redeveloped villages				Commodity housing			
	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid
Your neighbourhood as a place to live (Household survey)					0.178**		0.161*					
Quality of the neighbourhood (Household survey)							0.169*					
The character of the neighbourhood (Household survey)			0.147**									−0.121*
Number of landmarks (Site survey)			0.209**					0.167*				
Number of nodes (Site survey)							0.193**		0.130*			
Rating of nodes (Site survey)	0.137*		0.214**									
Neighbourhood boundary (Household survey)							0.230**					

Note: * and ** represent the results that are statistically significant at the 0.05 and 0.01 level, respectively.

Table 10
Correlations between other socio-spatial features of neighbourhoods and social interaction for locals.

Other socio-spatial features	Villages				Redeveloped villages				Commodity housing			
	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid
Your neighbourhood as a place to live (Household survey)					0.215*							
Quality of the neighbourhood (Household survey)												
The character of the neighbourhood (Household survey)			0.177*									-0.176*
Number of landmarks (Site survey)			0.174*			-0.220*		0.294**				
Number of nodes (Site survey)								0.243*				
Rating of nodes (Site survey)			0.182*									
Neighbourhood boundary (Household survey)								0.231*				

Note: * and ** represent the results that are statistically significant at the 0.05 and 0.01 level, respectively.

Table 11
Correlations between other socio-spatial features of neighbourhoods and social interaction for migrants.

Other socio-spatial features	Villages				Redeveloped villages				Commodity housing			
	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid	Chat	Borrow	Know	Avoid
Your neighbourhood as a place to live (Household survey)							0.203*					
Quality of the neighbourhood (Household survey)							0.221*					
The character of the neighbourhood (Household survey)												
Number of landmarks (Site survey)			0.240**							0.180*		
Number of nodes (Site survey)										0.209*		
Rating of nodes (Site survey)	0.248**		0.244**									
Neighbourhood boundary (Household survey)							0.260**			-0.189*		

Note: * and ** represent the results that are statistically significant at the 0.05 and 0.01 level, respectively.

residents’ movement trajectories. Therefore, in-depth interviews with residents to explore what other impacts might be and how they are related to social interaction can be worthy of further studies.

CRedit authorship contribution statement

Linyan Dai: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Xin Sheng:** Writing – review & editing. **Rangan Gupta:** Writing – review & editing.

Declaration of Competing interest

The authors have no conflicts of interest to declare.
Declarations of interest: none.

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