Neighbourhood Permeability and Burglary: A Case Study of a City in China

Much research from different fields has explored the crime-space relationship for different crime types with various study units. However, empirical studies in the diverse urban environments get conflict results that support the two contrary planning paradigms, 'open' and 'closed' solutions. Through a case study in one prosperous city in China, this research tries to detect the relationship between neighbourhood permeability and the burglary distribution pattern with the study unit of neighbourhood committees. This study focuses on three types of permeability, namely socio-economic, physical, and spatial ones. Our findings show that neighbourhoods with generally lower physical or spatial permeability allowing fewer people to enter or pass by are associate with burglary clustering. Socio-economic barriers offer a positive impact on burglary prevention. Nevertheless, the relationship between permeability and crime distribution is not geographically uniform over the whole city. A suggestion for future research is outlined in the conclusion.

Keywords: burglary; permeability; Residents' Committees; space syntax; Distribution Quotient

1. Introduction

Research investigating the urban environmental determinants of the spatial distribution of crimes has attracted full attention from environmental criminology, urban design, and urban planning. The explanations of how and why crime events clustering in particular urban environments are varied and under two factions. One could be traceable to the 'eyes on the street' (Jacobs 2011, 183) and argues that permeable environments bring more strangers as natural surveillants that inhabit crimes (Jacobs 2011; Cozen 2015; Reynald 2009, 2010). Another derives from the 'Defensible Space' (Newman 1972, 264) and advocates low density, single-use environments where strangers would be recognised and challenged by inhabitants as intruders. During the last four decades, rapid urbanisation in China brought many adverse effects, which called the government's attention to sustainability. Recent urban planning tactics advocate minimising energy consumption through moderate or denser building environments, mixed land-use, accessible networks, and walkable urban layouts. For example, in 2014, the State Council of the CPC Central Committee promulgated the "National New Urbanisation Plan (2014-2020)", which pointed out one essential urban development pattern, urban sprawl like 'making a pancake', existing in many Chinese cities. In those cities, wide roads and large squares were excessively advocated and adopted, which would lead to traffic congestion, low walkability, and empty urban district. And in 2016, The State Council of the CPC Central Committee promulgated the "Several Suggestions from the CPC Central Committee on Further Optimisation of Urban Planning and Construction Management" (hereafter abbreviated as "The Suggestion") that emphasised those urban issues again.

Additionally, in "The Suggestion" principles for urban planning were proposed: Optimising the road network structure and improving public service facilities. "The Suggestion" advocated the following detailed measures: gated-community should be opened up within which roads should be embedded into the public city network; universally accessible public space and community facilities should allow the diverse use for the neighbourhood; vivid urban environment should be constructed by landscape design that celebrates local history, climate and ecology. These measures could correspond to the main idea of the "New Urbanism" movement in the United States. The permeable urban setting has gained popularity to create a vibrant and walkable urban environment that could abate urban issues such as traffic congestion, air pollution, or excessive urban sprawl (Duncan et al. 2010; Cozens 2015; Kim 2016) and prevent crime (Cozen 2015; Reynald 2009, 2010).

However, the critics advocating 'defensible space' and 'Crime Prevention

Through Environmental Design (CPTED)' argued that the highly permeable environment would lead to more crimes (Armitage 2011; Johnson and Bowers 2010) and new aspects of unsustainability in terms of ecological costs, and social and economic impact (Gamman and Thorpe 2009). It was claimed that the CPTED approach forming highly territorial and access controlled communities could provide potential benefits of urban sustainability (Cozens 2007, 2008a, 2008b; Armitage and Monchuk 2009; Armitage and Gamman 2009; ACPO Secured by Design 2010; Shamsuddin and Hussin 2013; Marvi, Leleh and Mostafa 2015).

A large volume of literature documented empirical studies that support either positive or negative impacts of permeability on security, especially burglary. The concept of permeability taken from Taylor and Gottfredson (1986) is a central tenet of new urbanism, which describes the extent to which urban forms permit ease of movement (Cozens 2008a). Various factors have indicated permeability in previous empirical studies, and the results have not always been conclusive. In environmental criminology, permeability was always measured by physical variables. In 1982, Fowler and Mangione (1982) found that reducing the neighbourhood's access could prevent burglary and robbery in a short period. Long-term crime reduction could only be achieved by simultaneously physical permeability reduction and social organisation strengthen in neighbourhoods. White (1990) tested the permeability with similar indicators, the number of access lanes to the neighbourhood, and found that higher physical permeability would provide offenders with prominent attractions when other eco-demographic variables were controlled. Similar indicators such as the number of access lanes leading from the artery into the neighbourhood (Summers & Johnson, 2017) and road-types (Armitage, 2007) were adopted and proved criminogenic. In 1985, Taylor, Schumaker, and Gottfredson (1985) examined 66 neighbourhoods and found that the physical permeability indicated by land-use variations was only spuriously related to crime rates when socio-demographic variables were controlled. Hayslett-McCll (2002) and Browning et al. (2010) supported the negative impact of mixed land-use on crime prevention. Greenberg, Rohe, and Williams (1982) considered both mixed land-use and street type as physical permeability and found that neighbourhoods with homogeneous land-use and fewer major thoroughfares have less crime. However, there are also empirical studies that obtained contrast findings. Fowler (1987) found that homogeneity land-use and longer block are positively associated with high crime risk. Sohn's survey (2016) verified that when socio-economic variables were controlled, the numbers of restaurants, offices, and grocery stores are negatively correlated with residential crime risk. The spatial configuration based on the space syntax theoretical framework was included in urban permeability measures in recent years. Hillier and his colleagues found that higher permeable street network indicated by syntactic variables are correlated with lower crime risk (Hillier & Shu, 2000; Shu, 2000; Shu & Huang, 2003; Hillier, 2004; Shu, 2009). Van Nes (2005) and Chang (2011) applied space syntax measures to indicate street permeability and find that urban areas with higher configurational permeability were less vulnerable. Sohn et al.'s more recent study (2018) found that when socio-economic and eco-demographic factors were controlled, higher street integration and more offices and grocery stores are negatively associated with residential burglary. Permeability was also examined with space syntax methodology in urban environments in cities in China (Wang and Li, 2012; Wu et al., 2015; Yue et al., 2018). However, the results are not consentaneous. In Wuhan's study (Wu et al., 2015), it was claimed that permeability indicated by street segment sinuosity would increase burglary occurrence along streets. And in Yue and his colleagues' study (2018), streets with higher local configurational permeability indicated by local betweenness were proved to be safer; in contrast, streets with higher non-local permeability were expected to be dangerous. Additionally, the studies that examined the relationship between permeability and crime in the Chinese urban environment were mostly conducted at a street-segment level instead of an area level. The micro-scale segment level study could provide an elaborate explanation for crime location choice; however, it could not explore or consider the effect of the larger urban context.

In summary, the physical permeability has been mostly indicated by mixed land-use, access lane number, entrance number, or road type. And studies using space syntax added the configurational permeability in the explanatory variables. In most studies, socio-economic and demographical variables were considered and proved to play a significant role in crime variance. In this paper, the factor, permeability, was cross-examined to detect whether it influences burglary placement and concentration. Three perspectives of permeability, i.e. socio-economic, physical, and spatial permeability, were carefully examined in area-level analysis with a case study in a second-tier city in China. The Space Syntax technique was applied to quantify the degree of spatial permeability. The detailed findings and conclusion would provide instruction for local police intervention and sustainable city construction. Moreover, the methodologies applied in this study could also be used in other urban environments against different categories of crime analysis for future research. Due to the crime data protection, the studied city and residential committees have to be described anonymously. We presented the original study to investigate the issues at hand, discussed how the findings relate to the existing two schools of thought. The bivariate analysis was applied in the first step, and whereafter the multivariate analysis was conducted. Also, a suggestion was outlined for future research in the conclusion section.

2. Method

2.1 Study area

The case study area was an urban area of a Chinese city covering 1162.4 km^2 surrounded by the express beltway. The constructed area covered 568.8 km^2. The site comprised over 1.3 million households, 4.3 million population, and about 126166 street segments. Data concerning the street network and land-use were obtained from the Openstreet Map and referred to the latest Baidu map.

2.2 Data

2.2.1 Crime data collection and mapping

The burglary data in this study was collected from the local Public Security Bureau. Burglary records regarding address, times, and date for a five-year period – from 1st January 2014 to 31st December 2018 were extracted. After the crime mapping process, 22380 burglary records inside the 275 Residents' Committee boundaries were extracted and mapped out for analysis (Figure 1).

2.2.2 Land-use data and mapping

The study area was split into two categories, i.e. residential land-use and non-residential land-use, to examine the impact of mixed-use degree that indicated the physical permeability on burglary. The residential land-use was defined and mapped. 3761 residential communities were mapped out with the ArcGIS software (Figure 2). The total area of 3761 residential communities was 157.6 km^2, accounting for 13.6% of the total area.

2.2.3 Demographic data

The demographic data, including population and transient population for Residents' Committees (RCs) [1] at the end of 2018, were obtained from city sub-district offices to develop the socio-economic variables. The population in 275 RCs ranged from 630 to 109831; the transient population ranged from 8 to 83761.

2.3 Measurement of variables

2.3.1 Spatial unit of analysis——Residents' Committee

In this study, a Residents' Committees (RC) was defined as the study unit. It was the unit of basic level autonomy (village-level) administrative divisions in China. An RC is an essential local bureaucratic entity with defined administration boundaries and selected leaders. It ensures the social service, management affairs, resident's self-governance (Choate 1998), and public resource allocation in the city (Chen and Lu 2007; Xu and Chow 2011).

275 RCs were recognised and manually mapped out in the study area according to the descriptive information of the RCs administration boundaries in the government webpage based on the cities network map. According to the Chinese Official Urban and Rural Classification Code listed on the Chinese National Bureau of Statistics website, 275 RCs were classified into three main types: Urban RCs, Suburban RCs, and Rural RCs (Figure 3). The area of 275 RCs ranged from 0.012km^2 to 36.639km^2.

2.3.2 Measure of the dependent variable——Burglary Distribution Quotient (BDQ)

The dependent variable of this research was the Burglary Distribution Quotient (BDQ). BDQ was a new index developed by authors based on the Location Quotient Index in economics. BDQ quantified how concentrated the burglary cases were in an RC as compared to the whole city. In more exact terms, the Distribution Quotient is a ratio that compares a region to a larger reference region according to the crime density score. Compared with crime indicators applied in previous studies such as occurrence numbers (e.g. Yue et al. 2018), crime rate by population or households (e.g. Hillier and Shu 2000), crime density (e.g. Sohn 2016), or crime hot spot map (Eck et al. 2005), BDQ shows several superiorities. Firstly, it could better join other available socio-demographic data in this study. Secondly, by combining the density index and Location Quotient Index, BDQ emphasised the clustering degree instead of individual risk, which is more suitable for area-level study. The Burglary Distribution Quotient is a direct parameter that could guide government police resource allocation and determine how permeability factors impact the burglary clustering across the city.

The Burglary DQ takes the following form

$$Burglary\ DQ_i = \frac{x_i/y_i}{\sum_{i=1}^{275} x_i / \sum_{i=1}^{275} y_i} \qquad (1)$$

where x_i is the burglary count for ith RC, and y_i is the area for ith RC; 275 is the total number of RCs. When Burglary DQ (BDQ) for an RC is larger than 1, the RC has a proportionally higher burglary concentration than the average concentration across the city. Conversely, when BDQ for an RC is smaller than 1, the RC has a proportionally lower burglary concentration than the average concentration across the city.

The BDQ distribution map for all RCs was shown in Figure 4. It could be suggested in the BDQ map that the overall aggregation pattern of burglary was generally consistent with population density, which means burglary tended to concentrate in the population aggregation area. It could also be suggested that burglary events tended to cluster in the city centre rather than an area far away from the city centre. However, it could also be found that there were fewer RCs located far away from the city centre that feature high BDQ. Compared with the population density map, it could be found that the neighbourhood with high BDQ far away from the city centre (east and south) also featured relatively high population density. However, the relationship would be spurious when other variables were ignored. Therefore, more variables were considered blew.

2.3.3 Measure of variables: socio-economic permeability

In this paper, three types of permeability were considered. The socio-economic permeability was indicated by two variables. In the first step of descriptive statistical analysis, a binary variable, whether there is an urban or new urban (UNU) village in the RC, was applied. In the regression analysis, a continuous variable, the transient population proportion, was applied.

Urban villages *(chengzhongcun)*, literally a village in a city, are formed due to rapid urbanisation and the dual land system (Liu et al., 2010). New urban villages in the study area are usually resettlement communities constructed for local villagers after urban village demolition. Nevertheless, they still have a high similarity with urban villages in terms of collective land nature, ethnographic structure, architectural form, and demographic characteristics. Therefore, they were discussed together in this study. UNU villages in the case area are mainly located in downtown or suburban areas with significantly high building density and poor living conditions. However, due to convenient transportation and low rents, a large number of internal labour migrants and low-income populations gathered in UNU villages. The socio-economic permeability of RCs with UNU villages that featured lower inhabitant homogeneity was perceived as higher than RCs with normal commercial housings. Also, UNU villages featured a higher degree of social disorganisation (Shaw and McKay, 1942) and poor social control, which would facilitate crime committing. For a similar reason, the transient population proportion was applied to indicate the socio-economic permeability in the regression analysis. A higher proportion represented higher socio-economic permeability.

2.3.4 Measure of variables: physical permeability

The second aspect of permeability was physical permeability indicated by the non-residential land-use proportion. A high non-residential land-use proportion would bring more people flows who are not residents of the specific area. Hence, the land-use mixed degree could represent physical permeability. However, there was no consistent answer on how mixed land-use affects the burglary distribution (Sohn et al., 2018). According to previous studies, a higher residential to non-residential ratio creates better territoriality due to the higher degree of inhabitants' homogeneity (Ruijsbroek et al. 2015; Sohn 2016a, 2016b; Sohn et al. 2018). In this study, a higher non-residential rate represented a higher degree of physical permeability.

2.3.5 Measure of variables: spatial permeability

The spatial permeability was measured through the street configuration analysis of Space Syntax. In this study, the segment model's angular parameters were applied to estimate the street network permeability. According to Hillier (1996), local *closeness* best predicted pedestrian density on the local area streets. However, much later research found that *betweenness* seemed to be a more intuitive model for movement than *closeness* (Hillier and Iida 2005; Crucitti, Latora, and Porta 2006; Turner, 2007). To investigate how passing by people would impact the safety of the surrounding urban environment, and whether it would play a role as 'eyes on the street' (Jacobs 2011, 183), the local *betweenness* (choice) and *closeness* (integration) were chosen to indicate the through-movements and to-movement (Hillier et al. 1993) in this study. The metric radius 200m and 800m were used to indicate 5 minutes and 15 minutes walking distance.

An example was illustrated in Figure 5, representing the angular *closeness* R200. As *connectivity* has been proved to carry an elevated crime risk because streets with good links provided criminals more chance to escape (Beavon et al. 1994; Johnson et al. 2009), *connectivity* value was applied to examine how the degree of easy in and out affected crime clustering. For each RC, the segment length weighted average syntax values were computed to indicate the degree of spatial permeability.

2.3.6 Control variables

Literature found associations between some other factors such as proximity with the city centre (Matthews et al. 2010), neighbourhood demographic characteristics (Zhang and Peterson 2007), street density (Sohn, 2016a), and crime clustering. Therefore, three control variables, distance to downtown, population density, and total street segment length in RCs were included in the analysis.

3. Results

3.1 Bivariate analysis

3.1.1 Socio-economic permeability and BDQ

As a preliminary analysis, bivariate statistics could explore and compare the distribution of BDQ across levels of socio-economic and physical permeability. Figure 6 showed the box plot of the BDQ across three types of RCs with and without UNU villages. The T.

indicated RC groups with UNU villages. Generally, the BDQ of urban groups was significantly higher than those of suburban and rural groups. There was no apparent difference between BDQ distributions in T. or F. rural groups. For two suburban groups, the median, upper whisker, and maximum values for BDQ in T. suburban RCs were higher than those in the opposite group. For urban groups, the median in the T. group was slightly lower than the median in the F. group. Still, the third quartile, upper whisker, and outliners in the T. urban RCs were higher than those in the F. urban RCs.

RCs with UNU villages were always located close downtown, accommodating high population density, which might lead to analysis bias. Consequently, distance to downtown and population density factors were then controlled respectively. Figure 7 showed the box plot for the BDQ distributed across T. and F. RCs when the distance to downtown was controlled. When considering medians, interquartile ranges, upper whisker values, and outliers, it could be found that T. RCs showed higher BDQ than F. RCs in first and fourth distance groups. The result was similar to the outcome when the distance was not controlled. However, the abnormal situation appeared in half of the RCs in the second mid-centre and the third distal-centre distance groups. When outliers were ignored, F. RCs in the second distance group had higher BDQ. In the third distance group, the median, the maximum, and the third quartile values for the F. group were higher than the T. group; the upper whisker values in the T. group were higher than the F. group; the count for outliners in the T. group was larger than the F. group.

Figure 8 showed the box plot for BDQ distributed in T. and F. RCs when the population density was controlled. It could be suggested that when considering medians, interquartile ranges, upper whisker values, and outliers, T. RCs featured significantly higher BDQ than F. RCs in all population density groups. The result was similar to the result when the population density was not controlled.

3.1.2 Physical permeability and BDQ

Pearson Correlation analysis and scatter plot were applied to assess the association between land-use mix degree and BDQ. According to the Pearson correlation analysis, the non-residential land-use proportion ($p < .01$) to BDQ is -0.57. Namely, the non-residential land-use proportion was negatively correlated with BDQ. Figure 9 showed the scatter plot between the non-residential land-use proportion and BDQ for different RC types. It could be found that the BDQ for urban RCs showed an apparent negative correlation with the land-use mixed degree compared with suburban and rural RCs.

Figure 10 showed the relationship between the non-residential land-use proportion and BDQ when the distance to downtown was controlled. For four distance groups, BDQ decreased with the non-residential percentage increasing. In the fourth rim group, the negative correlation between the non-residential percentage and BDQ was weak. Moreover, when the distance was controlled, there was no apparent association between the non-residential percentage and BDQ for rural and suburban RCs.

Figure 11 showed the relationship between the non-residential land-use proportion and BDQ when population density was controlled. BDQ in four population density groups decreased along with the non-residential percentage increasing, especially for urban RCs. Additionally, the higher the population density, the stronger the negative relationship.

3.2 Multivariate analysis

A Poisson regression model was estimated using R software to examine the association between the BDQ and different perspective permeabilities after controlling for the population density and distance variables. The overdispersion test had a p-value larger than 0.05, suggesting no presence of overdispersion. Also, the diagnostic test indicated no serious multicollinearity between parameters.

During the model establishment, *betweenness R200* was found not to make a significant contribution to the Poisson model. After removing *betweenness R200* from explaining variables, the AIC for the reduced model declined, which means the reduced model fitted better than the original one. The final Poisson regression model result was shown in Table 1. It could be found that all the parameter estimates were significant at the 5% level.

The Exp (Est) represented the exponentiation of coefficients to interpret the regression coefficients in the dependent variable's original scale. It could be found that the Exp (Est) value for the transient population was larger than 1, which means when other variables controlled along with the temporary population increased, burglary clustering rose. In terms of physical permeability, the Exp (Est) values for the non-residential land-use percentage were much smaller than 1, which means when other factors were controlled along with the proportion of non-residential land-use increased, burglary clustering decreased. Those results were in line with the outcome of step one.

Among the five spatial permeability parameters, the most important explanatory variable was the *connectivity*. Along with averaged *connectivity* in an RC increased, the burglary clustering degrees decreased. The Exp (Est) value for *connectivity* was 0.682, which means that increased *connectivity* was associated with lower values of BDQ. More important, holding the other variables constant, a one-unit increase in *connectivity* multiplied the expected BDQ by 0.682. The second important spatial permeability parameter is *closeness R200,* which indicated the local to-movements pedestrians in 5 minutes radium. Such RCs with more local to-movements tended to have a relatively low concentration of burglary. The Exp (Est) value of 0.96 indicated that when the average degree of local *closeness* in an RC increased 1, the expected burglary DQ would time 0.96. In terms of other spatial variables, the degree of contribution to the model was small. The Exp (Est) values approximately equalled 1, which means these parameters were not crucial in explanatory burglary global regression models.

4. Discussion

Previous literature expressed two conflicting explanations on the relationship between crime concentration and permeability. This study attempted to determine how different permeability perspectives affected the burglary spatial concentration in Chinese urban environments, which would first address the shortcomings in previous research in China and secondly explain the reasons behind the inconsistent literature findings.

The bivariate analysis positively associated socio-economic permeability with burglary concentration. RCs with UNU villages were more likely to feature a higher burglary clustering degree, which was also in line with the social disorganisation theory. Nevertheless, the strong correlation did not appear in rural RCs or RCs quite far away from downtown. Additionally, in the second mid-centre and third distal-centre distance group, newly constructed RCs were more likely to attract burglary clustering. Compared with the first downtown distance group, newly constructed RCs in the mid-centre and distal-centre distance groups have more attractive wealthy targets. This could be explained by some other previous literature findings that most burglars were primarily driven by material profit (Reppetto, 1974; Bernasco and Nieuwbeerta, 2005). However, it could also be inferred that the driving factor, material profit, is not primary for crime target choosing everywhere; but is especially prior for target choosing for burglaries committed in a relatively affluent urban context. It could be expected that when burglars commit crimes in an affluent urban area, they prefer wealthy neighbourhoods despite the fact that they would be at a high risk of noticed or caught rather than poor ones, which could be easily accessed. Easy breaking into and escaping created by high socio-economic permeability were less attractive to burglars than material profit over those affluent urban contexts. However, the worst burglary concentration among RCs still appeared in RCs with high socio-economic permeability. The regression model also showed a positive correlation between socio-economic permeability indicated by transient population proportion and burglary concentration. That is to say, assuming that these relationships are the same everywhere within the study area, a more transient population would increase the burglary aggregation.

The bivariate analysis negatively associated physical permeability with burglary concentration for urban RCs. However, there was no apparent relationship between physical permeability and burglary clustering in suburban and rural RCs. Specifically, for urban RCs, the physical permeability-increasing was detrimental to burglary concentration. The regression model also showed a negative correlation between physical permeability and burglary concentration, which was in line with the bivariate analysis. This finding corresponds to many previous area-level empirical research (Sohn 2016a; Browning et al. 2010; Wo and Kim 2020). For instance, Sohn (2016a) found that the proportion of residential area was negatively correlated with residential crime density when other socio-economic variables were controlled. And Christopher et al. found that beyond a threshold commercial/residential density in the neighbourhood is negatively related to the homicide rate.

In the regression model, *connectivity* was negatively correlated with burglary concentration. Specifically, improving street connectivity contributes to preventing burglary clustering. This result was in line with much (e.g. Hillier and Shu 2000; Shu and Huang 2003; Hillier and Sahbaz 2008; Sohn 2018) but not all (e.g. Beavon et al.

1994; Johnson and Bowers 2010). Johnson and Bowers (2010) suggested that the well-connected street networks provided more chances for criminals to escape resulting in crime cases elevating. In Johnson and Bowers's study, the connection to different roads was classified, and connectivity or cul-de-sac was considered as a micro-scale variable. In contrast, in our research, the neighbourhoods' overall averaged connectivity degree was regarded as area-level permeability. Different research scales and urban environment might be the reason for the difference in results.

Moreover, burglary regression was negatively correlated with the local *closeness* representing 5 minutes to-movements on streets. It could be concluded that pedestrians with short-range destinations on streets had a benefit on burglary prevention. These findings corresponded to D.W.Sohn's study in 2018 at the street segment level. In Yue et al.'s (2018) study conducting in the urban environment at the segment level in China, the local and global *betweenness* variables were chosen and showed significant association with crime risk. In our research, *betweenness* was also considered initially; however, it showed no significant explanatory power in the Poisson model when *closeness* and other variables were controlled. What was consistent was that the local spatial permeability positively impacted on crime prevention, and non-local spatial permeability negatively impacted on crime prevention. The difference in syntactic variables chosen and the results might be caused by the difference in the study unit. Furthermore, in Yue et al's study, *closeness* had not been included, which could not exclude the influence of *closeness*. Therefore, we could infer that high *closeness* over the neighbourhood could prevent burglary aggregation in terms of macro-scale burglary distribution.

5. Conclusion

This study applied the correlation analysis and regression modelling approach to disentangle how different perspectives of permeability affect burglary distribution in the area-level unit. The study results appeared to have implications for crime-reductive planning, police source arrangement, and criminological research. Compared with the previous study in the urban environment in China, this study indicated that spatial permeability measured by space syntax variables could also be considered at the neighbourhood level. Specifically, in the further community-level or segment level study, the neighbourhood level spatial permeability effects mostly ignored in previous literature should also be considered and verified. In brief, socio-economic permeability carried an elevated burglary clustering, particularly in neighbourhoods closer to the city centre or densely populated. High physical permeability indicated by land-use diversity was associate with lower burglary clustering, especially for urban neighbourhoods. Spatial permeability indicated by *connectivity* and local *closeness* was associate with lower burglary clustering.

The relationship between permeability and burglary distribution was not uniform across all types of urban environment over the whole city, which means a kind of urban layout that prevent burglary occurrence here might not happen there. The different influences of various perspectives of permeability on burglary clustering within diverse RC types across different geographical locations were discussed in detail. For this study area, the design and management proposals would be clear.

RCs with any listed characters: UNU villages existence, affluent and adjacent to UNU villages, a large proportion of the transient population, homogeneity residential land-use, a large amount of cul-de-sac, and large gated real estates, should be allocated with more police resource allocation. Furthermore, the Residential Committees could play an important role in crime prevention in those neighbourhoods:

(1) The administrative organisation in charge of the RCs with high risk should provide more safety propaganda activities and strengthen the transit population management. Congregate activities in the neighbourhood scale could increase mutual understanding among RCs so that social control would rise.

(2) More public facilities and land-use allowing the diverse use of the inhabitants in the neighbourhood should be settled down. Various land-use and public facilities could accommodate more residents' activities to increase natural surveillance.

(3) Neighbourhoods segregated by massive real estates should be regenerated as "The Suggestion" proposed. The well-connected street network would appear to be a beneficial design feature and should be encouraged. Part of the private real estates' road could be embedded into the urban network to integrity the urban network and avoid too many cul-de-sacs.

It should be noted that the findings observed in this case study may not be suitable to the other urban contexts. Hillier (2004) suggested that replication would be necessary because urban contexts play an important role. Moreover, the traditional Poisson model assumes that the relationships between permeability and residential are uniform everywhere over the study area. However, some of the relationships varied geographically, which was also verified in the first stage analysis. In the future study, the Geographically Weighted Poisson Regression (GWPR) model could be applied to determine the relationship geographically varying. GWPR has been used in the residential burglary study in the Chinese environment by Chen and his colleagues (Chen et al. 2017) with the neighbourhood as a study unit. However, the spatial configurational characteristics have not been included in the explanatory variables. Further research could examine whether there will be any meaningful spatial variations in the relationships between burglary clustering and the explanatory permeability variables in the GWPR model.

1. In the 1950s, the government established Residents' Committees (RCs) (*jumin weiyuanhui*) in China's urban neighborhoods.

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