Place–time correlation of robbery incidents in metropolitan Lagos: a Mantel index analysis

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ABSTRACT
This article investigates the correlation of space and time in the clustering of robbery incidents in metropolitan Lagos. Analysis was carried out on 781 selected robbery incidents in 2013. Using the Mantel index to correlate place and time intervals for pairs of robbery incidents, the results show that robberies are respectively concentrated in residential areas, transport nodes and public places, peaking at midnight during weekdays. The results further show that this concentration is most likely greater than what would be expected on the basis of a chance distribution. The study concludes that various factors may exist which cause clusters of robberies to occur in these places at these times.

Introduction

Research has shown that different types of crime, particularly robbery and burglary, are clustered at spatial scales including provinces,[1] zones within cities,[2] street segments,[3] intersections,[4] and individual locations (such as the home environment and other types of accommodation).[5] Efforts to explain this phenomenon vary and consider a variety of mechanisms that might affect the likelihood of a crime occurring at a particular location (see the section on theoretical perspectives below).

Robbery is defined as the unlawful taking of property without consent and under confrontational circumstances from the immediate possession of a person, accompanied by force or violence, or threat of force or violence, and/or by placing the person (victim) in a state of fear for his or her safety.[6] This definition implies that property must be taken; however, the data in this study include both completed and attempted offences. There are two categories of robbery: armed robbery, defined as robbery conducted with the use of a weapon, and unarmed robbery, defined as 'robbery conducted without the use of a weapon'.[7] This study focuses on both, and data have been analysed within these definitions to ensure consistency and comparability between the jurisdictions.

Robbery is a common crime in Nigeria and is classified as a serious offence by the Nigeria Police Force (NPF).[8] The danger of robbery lies in its potential to develop into more serious and harmful crimes. If violence occurs in the commission of a robbery, other crimes such as shootings, assaults or – in the worst cases – murders could result. Needless to say, both victims and third parties – whether attempting to intervene or simply passing through the area – face grave danger in these situations. As such, robbery elicits strong feelings of fear for the Nigerian public.

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Robbery is considered to be a volume crime, occurring with enough frequency to make it amenable to statistical and spatial analysis.[9] The fact that robbery is perpetrated primarily against strangers and has the potential to occur in a variety of settings makes the likelihood that residents will fall victim to robbery higher than their chance of falling victim to other serious offences.[10] Studies have shown that predatory crime often manifests in clusters, or hot spots, defined as the geographical locations where crime is most concentrated.[11] Robbery is no exception; in fact, previous studies have found that concentrations are even greater for robberies than for other predatory offences.[12]

In this study, a space–time analysis is used on robbery data from the city of Lagos, which is the most populous city in Nigeria, the second fastest-growing city in Africa, and the seventh fastest-growing city in the world.[13] The city is situated within the latitudes 6°23'N and 6°41'N and the longitudes 2°42'E and 3°42'E in the southwest geopolitical zone of Nigeria. With the increasing urbanisation of Lagos, there has been a severe strain on the existing social infrastructure and there are increasing numbers of unemployed and underemployed.

The deplorable conditions – particularly in the many slums and shantytowns of the Lagos metropolis – offer a fertile breeding ground for criminal activities. As Lagos has experienced a gradual increase in population, it has simultaneously experienced an increase in crime – particularly break-ins, motor thefts and robberies. The estimated mean robbery rate for the most recent five-year period (2009–14) is 192 per 10 000 citizens.[14] This high rate of crime is mainly due to the population explosion, economic inequality and deprivation, social disorganisation, poor governance, unemployment among youth, and a weak and under-resourced law enforcement institution. It is estimated that by 2020, the robbery rate in the metropolis will be approximately 78 incidents per 10 000 persons per year,[15] which doubles the 2009–14 rate. It should also be noted that these proportions are likely to surge upward when other crime incidences are considered together with robbery.

In order to analyse how space and time in the urban environment might affect offender decision-making with regard to committing robbery in Lagos, the Mantel index technique was used. The Mantel index is generally used to test for correlations between two dissimilar matrices that summarise comparisons between pairs of points. Essentially, it is a correlation between distance, space and time intervals for pairs of incidents. Using this technique, time can be viewed in terms of hours, days, weeks, months or years, while place can be viewed geographically and/or sociologically. Geographically, place is defined as a fixed environment that can be seen completely and simultaneously, at least on its surface, by the naked eye; sociologically, place is the social organisation of behaviour in a geographic location.[16] As is the case with people, place and time can be seen as having an influence on criminal activities such as robbery.

Place–time interaction

Four distinct interactions can occur between space and time. First, there could be spatial clustering all the time. This is apparent when some communities or zones within a community are prone to certain events. A situation where robberies are often concentrated in one particular location while vehicle thefts occur in another location is a good example. In this case, there is no space–time interaction, since the clustering occurs all the time. Second, there could be spatial clustering within a specific time period. This means that hot spots could occur during certain time periods. For example, motor vehicle accidents tend to occur with a

much higher frequency in the late afternoon and early evening, often as a by-product of congestion on the roads. Collision hot spots will therefore tend to occur at certain times because of traffic congestion.

The third distinction is space–time clustering. In this interaction, a number of events occur within a limited time period in a concentrated area or a limited location. This type of effect is very common with acquisitive crimes such as robberies and motor vehicle theft. Robbers and car theft gangs may decide to attack a particular locality. After a binge of robberies, the cluster moves from one location to another. As such, spatial hot spots appear at particular times but are temporary. The ability to detect this type of shift is very important for police since it affects the ability of law enforcement to respond.

Finally, there is the space–time interaction. In this case, the relationship between space and time is more complex. The interaction could be concentrated in the form of spatial clustering (discussed above) or it could follow a more complex pattern. For example, vehicle thefts may shift towards broader communities during certain periods. Although this type of diffusion is not regarded as clustering per se because it is spread over a larger area, it is a distinctive space–time interaction and identifying such interactions is an important step in planning an intervention strategy.

Theoretical perspectives

The most common type of theory used to explain criminal acts of different types is the opportunity theory, which focuses on crime events as outcomes of a series of decisions made by offenders and influenced by the social and physical context of the place. Rather than relying solely on offender motivation to explain criminal behaviour, opportunity theories examine all the actors, as well as the characteristics of the place where the crime occurs. Three opportunity theories exemplify this approach: rational choice perspective,[17] routine activity theory,[18] and environmental criminology,[19] as well as an integrative framework called the criminal event perspective (CEP).[20]

The rational choice perspective addresses how offenders make the decision to offend.[21] The rational choice perspective posits that offenders use a form of 'bounded rationality' when making the decision to commit a specific offence.[22] Rational choice perspective does not assume that offenders have picture-perfect knowledge but rather recognises that offenders make decisions based on previous experience and situational factors. This perspective assumes that offender behaviour is essentially similar to that of non-offenders and that the offender's familiarity with a place tends to reduce the perceived amount of risk. Finally, the decision to commit a specific crime is represented as an evaluation of three factors: the suitability of the situation, the presence of a viable target, and the level of guardianship.

Routine activity theory connects routine human behaviour with societal trends.[23] These theorists were the first to highlight the convergence of actors in space and time as critical to a crime occurring. Routine activity theory originally identified three elements necessary for a crime to occur: a motivated offender, a suitable target, and the lack of a capable guardian.[24] More recent extensions have added the roles of intimate handlers and place managers as potential guardians, as well as acknowledging the importance of place.[25] These advances have been integral to the development of place-based explanations of crime.

Environmental criminology has identified five necessary elements for a crime to occur: a legal setting, a motivated offender, a suitable victim, the lack of a capable guardian, and

place.[26] However, offender behaviour and place have been consistently emphasised in the writing of environmental criminology theorists. Offenders are viewed as being constantly aware of opportunities to commit crimes, constantly gathering information about places through their daily routine activities.[27] Only if the potential benefit outweighs the risk does an offender commit an offence. Environmental criminology also emphasises the dual role of place in crime. Places serve as crime attractors or crime generators based on their function.[28] Attractive places tend to be locations that draw a lot of people for work, shopping or recreation and where there is a relative lack of effective or consistent guardianship. A crime attractor is a target-rich environment that may exist only at certain times of the day when businesses and/or other attractions are open to draw people to that location. Such places are typically characterised by a high density of commercial land use and a low density of residential land use. People, including offenders, generally move to such locations. A crime generator, by comparison, is a location that tends to be conducive to criminal enterprise and activity due largely to its social and physical geography. Crime tends to flourish in areas with high levels of social disorganisation, residential instability and mixed land use.[29]

Places are integral components of the overall form of a city. The accessibility of a place determines how many people are aware of it and how willing they are to travel there. In this way, place characteristics and urban form work together to impact the spatial behaviour of both offenders and victims. Hence, they are fundamental to understanding why crimes occur where they do. CEP seeks to better understand the criminal act as part of a chain of actions and influences through combining offender and victim behaviour with environmental context.[30] The interaction between the roles of the offender(s), the victim(s) and any witnesses are viewed as dynamic rather than fixed. The development of criminal events and the resulting aggregate patterns are grounded in the dynamic conflation of individual decisions that are influenced by the societal customs and the physical environment of the place in which they are made. This dynamic view of victimisation echoes the work of Rountree and Land, who note that previous victimisation affects future behaviour.[31] Routine behaviours of victims are altered, which in turn changes the risk associated with them.

Together, these theoretical developments and empirical studies have led to an increasing recognition of the importance of micro-level places in achieving a better understanding of crime patterns. They also provide a solid foundation from which to examine the space–time distribution of robberies.

Method and findings

This study is based on data collated from the records of the NPF. These records relate to either all or a subset of reported robbery incidents that occurred in metropolitan Lagos between January and December 2013. A total of 2 549 of armed and unarmed robberies are recorded for this period. It is expected that the actual figure is higher, as not all crimes are reported. The low number could also be attributed to the fact that many citizens (particularly victims of crime) in Nigeria are not ready to respond to existing and emerging crime reporting demands. Having sorted the available data, a total of 781 cases were deemed sufficiently detailed for the purpose of this study, and analytical techniques were adopted and employed in the final analysis. The quantitative analysis involves a descriptive account of the place and time at which each incident occurred. The Mantel index was used to correlate place and time

intervals for pairs of robbery incidents. This index is used to test for the correlation between two dissimilar matrices that summarise comparisons between pairs of points. It is based on a simple cross-product of two interval variables such as space and time, as follows:

$$T = \sum_{i=j}^{n} \sum_{j=i}^{n} (Xij - Mean)(Yij - Mean), \tag{1}$$

where X_{ij} is an index of similarity between two observations i and j for the space variable and Y_{ij} is an index of similarity between the same two observations i and j for the time interval variable. The cross-product is then normalised by dividing each deviation by its SD:

$$r = \frac{1}{n-1} \sum_{i=j}^{n} \sum_{j=i}^{n} (Xij - Mean)/Sx*(Yij - Mean)/Sy) \tag{2}$$

$$= \sum_{i=j}^{n} \sum_{j=i}^{n} (Zx*Zy)/(-1) \tag{3}$$

Sx _ Standard Deviation of x,
Sy_ Standard Deviation of y,
Zx and Zy _are the normalised variables
where X_{ij} and Y_{ij} are the original variables for comparing two observations i and j, and Zx and Zy are the normalised variables.

To analyse 781 cases of robbery in metropolitan Lagos, simulations were calculated for each time of the day and day of the week using the same sample size as the period's robbery totals. Because an extreme value can be obtained by chance with a random distribution, reasonable cut-off points are usually selected from the simulation. In this case, a cut-off point that approximates a 5% significance level was chosen. Since the Mantel index is a two-tailed test (one could just as easily get dispersion between space and time as clustering), a lower threshold of the 2,5 percentile and an upper threshold of the 97,5 percentile is adopted. These two cut-off points ensure that approximately 5% of the cases are either lower than the lower threshold or higher than the upper threshold under random conditions. In other words, only if the observed Mantel index is smaller than the lower threshold or larger than the upper threshold will the null hypothesis of a random distribution between space and time be rejected. Except where otherwise stated, all tables were derived by the author from robbery incident data.

The records received from the NPF include brief descriptions of the location of incidents. Over 60 separate types of locations are described. In order to extract distribution patterns, these needed to be grouped. From the summary of robbery cases by place of occurrence (see Table 1), it is revealed that residential areas had the highest rate (30,0%), while workplaces

Table 1 Robberies by location type ($n = 781$)

Location type	%
Residential areas	30.2
Transport and related	29.0
Work places	9.5
Public places	20.8
Commercial areas and related	10.5

Note *Residential areas* comprises motels, hotels, home units/houses and their surroundings, as well other accommodation; *Transport and related* comprises taxicab and transport terminals, bus stops, car parks and streets, paths and bus stops; *Workplaces* comprises offices and government establishments; *Public places* comprises public grounds, adult entertainment venues, museums, libraries, churches, galleries, recreational locations, hospitals and other medical locations, and schools; *Commercial areas and related* comprises financial institutions, restaurants and cafés, corner stores, milk bars and takeaway food shops, saloons and licensed clubs, service stations, post offices and other retail businesses and commercial sites.

Table 2 Robberies by time ($n = 781$)

Time of day	Weekdays (%)	Weekends (%)
Daytime (5:00 a.m. to 6:59 p.m.)	40.2	59.8
Evening (7:00 p.m. to 11:59 p.m.)	55.0	45.0
Night-time (12:00 a.m. to 4:59 a.m.)	60.5	39.5

Note Weekdays comprise Monday, Tuesday, Wednesday and Thursday; Weekends comprise Friday, Saturday and Sunday.

recorded the lowest rate (9,5%). While 10,5% of the 781 cases of robbery in 2013 occurred in commercially-related areas, the proportion of the incidents that occurred in transport-related areas and commercial places were 29,0% and 20,8%, respectively.

From the summary presented in Table 2, it is revealed that robbery events occurred most often at around midnight on weekdays (60,5%). The next most frequently occurring time is the daytime during the weekend (59,8%). Further analysis reveals that of the 781 cases of robbery incidents in 2013, approximately 55,0% and 45,0% occurred in the evenings on weekdays and weekends, respectively.

The result of the Mantel index routine correlation between space and time interval is summarised in Table 3. As can be seen, the correlations are all generally low. For the entire period of the day observed, the Mantel index (correlation between space and time) is 0,004. The 2,5 percentile is 0,002 and the 97,5 percentile is 0,003. However, the period around midnight has a correlation above the upper cut-off threshold. Similarly, for the entire period of the week, the Mantel index (correlation between space and time) is 0,009. The 2,5 percentile is −0,005 and the 97,5 percentile is 0,006. Nonetheless, the periods of Saturday and Sunday have correlations above the upper cut-off threshold. Furthermore, the observed values in both cases are between the two cut-off points.

Discussion and conclusion

Research has shown that predatory crime often manifests in clusters. The findings are similar for robberies; previous studies have found that the concentration of robbery incidents is greater than other predatory offences.[32] This study affirms robbery concentration over space and time. The results show that robberies are concentrated in residential areas, transport nodes and public areas, which supports previous studies showing that transit nodes correlate with high human activity and therefore attract criminal activity.[33] As explained by Block and Block, certain factors are present within the transit environments that facilitate the commission

Table 3 Mantel index for the median split of metropolitan Lagos robberies ($n = 781$)

Time of day	r	Simulation (2.5%)	Simulation (97.5%)	p
Daytime (5:00 a.m. to 6:59 p.m.)	.041	−.042	.043	n.s.
Evening (7:00 p.m. to 11:59 p.m.)	.009	−.039	.038	n.s.
Night-time (12:00 a.m. to 4:59 a.m.)	.061	−.047	.040	.001*
All for 2013	**.004**	**−.002**	**.003**	**n.s.**
Day of the week				
Monday	−.025	−.031	.033	n.s.
Tuesday	.008	.043	.041	n.s.
Wednesday	.002	−.040	.040	n.s.
Thursday	.004	−.037	.041	n.s.
Friday	.035	−.031	.042	n.s.
Saturday	.054	−.033	.042	.010*
Sunday	.001	−.045	.033	.025**
All for 2013	**.009**	**−.005**	**.006**	**n.s.**

Note *Significant at .05; **significant at .01; n.s. = not significant.

of crime.[34] These factors include a lack of suspicion from passers-by that aids the offender in diverting attention away from him or herself, easily accessed entrances and exits that keep the risk of getting caught relatively low, and the target's lack of knowledge about the area and others in the area that leaves him or her susceptible to victimisation.

The results of this study show that robberies are most concentrated around midnight during weekdays and in the daytime during the weekends. This is because robbery involves confrontation, usually accompanied by the threat of force and instilling fear in the victim. Hence, during these periods, residential areas/houses (i.e. the zones with highest levels of robbery occurrences) are more likely to be occupied by potential victims. The proportion of robberies at night during weekdays and during the daytime at weekends in metropolitan Lagos has risen sharply, since many more homes are likely to be fully occupied during these periods. Conversely, the proportion of daytime robberies during the week has reduced, since many more homes are unoccupied during the day. This is probably the result of the increasing rate of female employment and free child enrolment in primary and secondary schools (particularly for girls). Prior to the mass entry of women into the workforce and children's enrolment at school in Nigeria, residential robberies tended to be more diurnal.

The Mantel index analysis does not allow the null hypothesis of no relationship between space and time to be totally rejected. However, the period of around midnight on Saturdays and Sundays has a correlation above the upper cut-off threshold; for this period, the amount of space–time clustering in the robbery incidents data is most likely greater than what would be expected on the basis of a chance distribution. Hence, the presence of robbery hot spots and time shown in this study suggests that factors may exist that cause crime to occur in clusters. Though it may not be the only previously offered explanation, this study submits that space (geographic or sociological) as well as time (in term of hours, days, weeks, months or years) can serve as factors which lead to the clustering of robbery.

The present study provides further evidence to support routine activities and social disorganisation theory (see the section on theoretical perspectives above), establishing that assumptions of these theories are true for a type of crime (robbery) not previously studied in Nigeria, and for a geographic location not studied elsewhere (Lagos), thus expanding the validity of the study base and demonstrating the broad view of these theories in terms of explaining the distribution of different types of crime. In addition, this study extends the understanding of criminology by showing that the connectivity of space and the distribution of routine activity appear to have a direct correlation on robberies in the study area.

These results are relevant for policy intervention and urban planning. Crime prevention and police intervention should concentrate their resources on the hot spots pointed out in terms of space and time. For example, specific places of crime concentration are motels, hotels, the home unit, transport terminals, bus stops, car parks, streets and paths, as well adult entertainment venues. State police departments should ensure that there is adequate security in these places. Regular security inspections of transport terminals, bus stops, car parks, streets, paths and adult entertainment venues by police will reveal robbery hot spots. These inspections could be used to guide the targeted deployment of an anti-robbery squad to the most dangerous spaces during the most dangerous times (at night during weekdays and during the daytime at weekends). It should also be noted that the policy implications of robbery clustering/hot spots are much broader than the remit of the police, hence intervention should be engaged with by many other agencies of government in the regulation and treatment of places.

Users of public spaces should be educated on their personal safety; education is needed to encourage appropriate behaviour, redirect responsibility to the perpetrators of robberies, promote awareness, and encourage intervention where possible. Users of public spaces should be conscious of their security and should avoid commuting alone, particularly at night. Town planners can apply design strategies to different components of public places in an effort to enhance the environmental factors that reduce robberies or eliminate those that promote it. For instance, motels, hotels, homes, transport terminals, bus stops, car parks, streets, paths and adult entertainment venues should be located away from sparse environments, empty lots and vacant buildings, and close to people and activities. This is an essential step in preventing robberies.

Natural surveillance of spaces is also very important in preventing robberies, which occurs when the placement of physical features, activities and people is designed in such a way as to maximise visibility and foster positive social interaction among the users of private and public spaces. Well-connected streets and door-to-door inter-visibility between houses on both sides of roads are important factors in helping to protect residences. Planners and residents should ensure that features of the landscape – such as trees, shrubs and flowerbeds – do not obstruct their vision of the immediate environment and create areas of concealment where intruders or robbers could hide. The artificial surveillance of spaces is also very important through the use of electronic devices to ensure visual control over spaces. For instance, cameras can act as a deterrent to crime in the immediate area and/or assist to catch robbers in the act. These can be positioned in strategic places to monitor daily activities within their viewing range and send fast signals and alerts to the nearest police station in the case of robbery. The most sophisticated of these electronic monitoring devices is closed circuit television (CCTV). It is believed that a visible environment is a safe place,[35] and it is therefore suggested that private and public spaces should be well lit, while transport networks should be provided with adequate and functional street lighting at night.

Acknowledgements

Notes

1. Quetelet, *Treatise on Man*.
2. Shaw and McKay, *Juvenile Delinquency and Urban Areas*; Badiora, 'Spatio-Temporal Pattern of Crime.'
3. Groff, Weisburd, and Yang, 'Crime Trends at a Local "Micro" Level'; Johnson and Bowers, 'Guardianship Dynamics across the Street Network.'
4. Sherman, Gartin, and Buerger, 'Hot Spots of Predatory Crime.'
5. Pease, 'Repeat Victimisation: Taking Stock'; Eck, Clarke, and Guerette, 'Risky Facilities'; Sherman, Gartin, and Buerger, 'Hot Spots of Predatory Crime'; Badiora, Oluwadare, and Dada, 'Residential Burglary and Prevention.'
6. Matthews, *Armed Robbery*.
7. Ibid 10.
8. Aliu, 'Reign of Armed Gangs.'
9. Sherman, 'Attacking Crime.'
10. Cao and Maume, 'Urbanization, Inequality, Lifestyles and Robbery.'
11. Brantingham and Brantingham, 'Mapping Crime for Analytic Purposes.'

12. Sherman, Gartin, and Buerger, 'Hot Spots of Predatory Crime'; Roncek and Maier, 'Bars, Blocks, and Crimes Revisited.'
13. UNDP, *State of the Lagos Megacity Report.*
14. NPF, *Crime Report.*
15. Ibid.
16. Sherman, Gartin, and Buerger, 'Hot Spots of Predatory Crime.'
17. Cornish and Clarke, 'Introduction.'
18. Ibid.
19. Brantingham and Brantingham, *Environmental Criminology.*
20. Rountree and Land, 'Perceived Risk versus Fear of Crime.'
21. Cornish and Clarke, 'Introduction.'
22. Ibid.
23. Cohen and Felson, 'Social Change and Crime Rate Trends'; Groff, 'Routine Activities Theory and Street Robbery'; Groff, 'Temporal and Spatial Aspects of Routine Activities.'
24. Felson, 'Routine Activities and Crime Prevention.'
25. Ibid.; Eck, 'Drug Markets and Drug Places'.
26. Brantingham and Brantingham, 'Crime Pattern Theory.'
27. Ibid.
28. Ibid.; Brantingham and Brantingham, *Patterns in Crime*; Brantingham and Brantingham, 'Environment, Routine, and Situation.'
29. Bursik, 'Social Disorganization and Crime and Delinquency'; Sampson and Groves, 'Community Structure and Crime'; Taylor, 'Social Order and Disorder of Street Blocks'; Osgood, 'Analysis of Aggregate Crime Rates'; Groff, 'Routine Activities Theory and Street Robbery.'
30. Rountree and Land, 'Perceived Risk versus Fear of Crime.'
31. Ibid.
32. Sherman, Gartin, and Buerger, 'Hot Spots of Predatory Crime'; Andresen, 'Spatial Analysis of Crime in Vancouver'; Van Koppen and Jansen, 'The Road to Robbery.'
33. Shaw and McKay, *Juvenile Delinquency and Urban Areas*; Block and Block, 'The Bronx and Chicago.'
34. Block and Block, 'The Bronx and Chicago.'
35. Badiora, 'Spatio-Temporal Pattern of Crime.'

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Bibliography

Aderogba, Kofo, Martins Oredipe, Shade Oderinde, and Toun Afelumo. 'Challenges of Poor Drainage Systems and Floods in Lagos Metropolis, Nigeria.' *International Journal of Social Sciences and Education* 2, no. 3 (2012): 412–427.

Alford, Valerie. 'Crime and Space in the Inner City.' *Urban Design Studies* 2 (1996): 45–76.

Aliu, A. 2010. 'Reign of Armed Gangs on the Roads, Homes, Dims Nigeria's Security Bar.' *The Guardian*, 9 April.

Andresen, Martin A. 'Location Quotients, Ambient Populations, and the Spatial Analysis of Crime in Vancouver, Canada.' *Environment and Planning A* 39, no. 10 (2007): 2423–2444. doi:10.1068/a38187

Badiora, Adewumi Israel. 'Spatio-Temporal Pattern of Crime and Delinquency in Ile-Ife, Nigeria.' MSc diss., Obafemi Awolowo University, 2012.

Badiora, Adewumi Israel, Deborah Bunmi Oluwadare, and Olanrewaju Timothy Dada. 'Nature of Residential Burglary and Prevention by Design Approaches in a Nigerian Traditional Urban Center.' *Journal of Applied Security Research* 9, no. 4 (2014): 418–436. doi:10.1080/19361610.2014.942823

Block, Richard, and Carolyn Rebecca Block. 'The Bronx and Chicago: Street Robbery in the Environs of Rapid Transit Stations.' In *Analyzing Crime Patterns: Frontiers in Practice*, edited by Victor Goldsmith, Philip G. McGuire, John H. Mollenkopf, and Timothy A. Ross, 137–152. London: Sage, 2000.

Brantingham, Paul J., and Patricia L. Brantingham. 'Crime Pattern Theory.' In *Environmental Criminology and Crime Analysis*, edited by Richard Wortley and Lorraine Mazerolle, 78–93. Cullompton: Willan, 2008.

Brantingham, Paul J., and Patricia L. Brantingham. *Environmental Criminology*. Prospect Heights, IL: Waveland Press, 1981.

Brantingham, Paul J., and Patricia L. Brantingham. 'Environment, Routine, and Situation: Toward a Pattern Theory of Crime.' In *Routine Activity and Rational Choice*, edited by Ronald V. Clarke and Marcus Felson, 259–294. Piscataway, NJ: Transaction, 1993.

Brantingham, Paul J., and Patricia L. Brantingham. 'Mapping Crime for Analytic Purposes: Location Quotients, Counts, and Rates.' In *Crime Mapping and Crime Prevention*, edited by David Weisburd and Tom McEwen, 263–288. Monsey, NY: Criminal Justice Press, 1997.

Brantingham, Paul J., and Patricia L. Brantingham. *Patterns in Crime*. New York, NY: MacMillan, 1984.

Building Nigeria's Response to Climate Change (BNRCC) Project. *Towards a Lagos State Climate Change Adaptation Strategy*. Ibadan: BNRCC, 2012.

Bursik, Jr, Robert J. 'Social Disorganization and Theories of Crime and Delinquency: Problems and Prospects.' *Criminology* 26, no. 4 (1988): 519–522. doi:10.1111/j.1745-9125.1988.tb00854.x

Cao, Liqun, and David J. Maume, Jr. 'Urbanization, Inequality, Lifestyles and Robbery: A Comprehensive Model.' *Sociological Focus* 26, no. 1 (1993): 11–26. doi:10.1080/00380237.1993.10570993

Cohen, Lawrence E., and Marcus Felson. 'Social Change and Crime Rate Trends: A Routine Activities Approach.' *American Sociological Review* 44, no. 4 (1979): 588–608. http://www.jstor.org/stable/2094589

Cornish, Derek B., and Ronald V. Clarke. 'Introduction.' In *The Reasoning Criminal: Rational Choice Perspectives on Criminal Offending*, edited by Derek B, Cornish & Ronald V, Clarke. New York, NY: Springer, 1986, 89–110.

Eck, John E. 'Drug Markets and Drug Places: A Case-Control Study of the Spatial Structure of Illicit Drug Dealing.' PhD diss., University of Maryland, 1994.

Eck, John E., Ronald V. Clarke, and Rob T. Guerette. 'Risky Facilities: Crime Concentration in Homogeneous Sets of Establishments and Facilities.' In *Imagination for Crime Prevention: Essays in Honour of Ken Pease*, edited by Graham Farrell, Kate J. Bowers, Shane D. Johnson, and Mike Townsley, 225–264. Monsey, NY: Criminal Justice Press, 2007.

Felson, Marcus. 'Routine Activities and Crime Prevention in the Developing Metropolis.' *Criminology* 25, no. 4 (1987): 911–931. doi:10.1111/j.1745-9125.1987.tb00825.x

Groff, Elizabeth R. 'Adding the Temporal and Spatial Aspects of Routine Activities: A Further Test of Routine Activity Theory.' *Security Journal* 21, no. 1 (2008): 95–116. doi:10.1057/palgrave.sj.8350070

Groff, Elizabeth R. 'Simulation for Theory Testing and Experimentation: An Example Using Routine Activities Theory and Street Robbery.' *Journal of Quantitative Criminology* 23, no. 2 (2007): 75–103. doi:10.1007/s10940-006-9021-z

Groff, Elizabeth R., David L. Weisburd, and Sue-Ming Yang. 'Is It Important to Examine Crime Trends at a Local "Micro" Level? A Longitudinal Analysis of Street to Street Variability in Crime Trajectories.' *Journal of Quantitative Criminology* 26, no. 1 (2010): 7–32. doi:10.1007/s10940-009-9081-y

Johnson, Shane, and Kate Bowers. 'How Guardianship Dynamics May Vary across the Street Network: A Case Study of Residential Burglary.' In *Eenvoud en verscheidenheid: Liber amicorum voor Henk*

Elffers, edited by Stijn Ruiter, Wim Bernasco, Wim Huisman, and Gerben Bruinsma, 305–318. Amsterdam: Vrije Universiteit Amsterdam, 2013.

Matthews, Roger. *Armed Robbery*. Cullompton: Willan, 2002.

Nigeria Police Force (NPF). *Crime Report*. Lagos: NPF, 2014.

Oduwaye, Leke. 'Spatial Variations of Values of Residential Land Use in Lagos Metropolis.' *African Research Review* 2, no. 3 (2009): 381–403. http://www.ajol.info/index.php/afrrev/article/view/43638

Osgood, D. Wayne. 'Poisson-Based Regression Analysis of Aggregate Crime Rates.' *Journal of Quantitative Criminology* 16, no. 1 (2000): 21–43. doi:10.1023/A:1007521427059

Pease, Ken. *Repeat Victimisation: Taking Stock*. London: Home Office, 1998.

Quetelet, Lambert-Adolf-Jacques. *A Treatise on Man and the Development of His Faculties*. Edinburgh: W. & R. Chambers, 1973.

Roncek, Dennis W., and Pamela A. Maier. 'Bars, Blocks, and Crimes Revisited: Linking the Theory of Routine Activities to the Empiricism of Hot Spots.' *Criminology* 29, no. 4 (1991): 725–753. doi:10.1111/j.1745-9125.1991.tb01086.x

Rountree, Pamela Wilcox, and Kenneth C. Land. 'Perceived Risk versus Fear of Crime: Empirical Evidence of Conceptually Distinct Reactions in Survey Data.' *Social Forces* 74, no. 4 (1996): 1353–1376. http://www.jstor.org/stable/2580354

Sampson, Robert J., and W. Byron Groves. 'Community Structure and Crime: Testing Social Disorganization Theory.' *American Journal of Sociology* 94, no. 4 (1989): 774–802. doi:10.1086/229068

Shaw, Clifford R., and Henry D. McKay. *Juvenile Delinquency and Urban Areas: A Study of Rates of Delinquency in Relation to Differential Characteristics of Local Communities in American Cities*. Chicago, IL: University of Chicago Press, 1942.

Sherman, Lawrence W. 'Attacking Crime: Police and Crime Control.' *Crime and Justice* 15 (1992): 159–230. doi:10.1086/449195

Sherman, Lawrence W., Patrick R. Gartin, and Michael E. Buerger. 'Hot Spots of Predatory Crime: Routine Activities and the Criminology of Place.' *Criminology* 27, no. 1 (1989): 27–55. doi:10.1111/j.1745-9125.1989.tb00862.x

Taylor, Ralph B. 'Social Order and Disorder of Street Blocks and Neighborhoods: Ecology, Micro Ecology, and the Systemic Model of Social Disorganization.' *Journal of Research in Crime and Delinquency* 34, no. 1 (1997): 113–155. doi:10.1177/0022427897034001006

United Nations Development Programme (UNDP). *State of the Lagos Megacity Report*. New York, NY: UN, 2004.

Van Koppen, Peter J., and Robert W. J. Jansen, 'The Road to Robbery: Travel Patterns in Commercial Robbery.' *The British Journal of Criminology* 38, no. 2 (1998): 230–246. http://bjc.oxfordjournals.org/content/38/2/230.abstract