Journal of The Nigerian Institute of Architects (NIAJ)
ISSN: 1595-4110

Crime and Security Management: An Overview of the Role of Space Syntax Analysis

Fatima Baba Ciroma[1], Musa Lawal Sagada[2], Joy Joshua Maina[3], Aisha Wali Aminu-Umar[4]

[1]Department of Architecture, College of Environmental Studies Kaduna Polytechnic, Kaduna Nigeria
ciromafb@gmail.com
[2&1]Department of Architecture, Faculty of Environmental Design, Ahmadu Bello University Zaria Nigeria
Msagada2010@gmail.com
[3]Department of Architecture, Faculty of Environmental Design, Ahmadu Bello University Zaria Nigeria
joyamina16@gmail.com
[4]Department of Architecture, College of Environmental Studies Kaduna Polytechnic, Kaduna Nigeria
ayshaaminuumar@gmail.com

***Abstract:** Crime is a negative phenomenon that has a devastating effect on society and the quality of life therein. It is a known fact that for most countries, the largest expenditure of the government is on the prevention and response capacity to the occurrence of crime. Security management is one of the effective ways to prevent crime, and a good security management system has the potential to bring down the costs associated with crime prevention. It is in this regard that this paper investigates the reality of crime and the factors responsible for the occurrence of crime. The major contribution of this paper is in the analysis of security management as a tool for the prevention of crime. The analysis presents the types of techniques used in security management useful in crime prevention, with special emphasis on space syntax analysis and how it can be used by architects to produce building, and neighborhood designs which efficient and cost-effective in the management of crime. It is a fact that geographic location affects how well a security management technique will work; it is in this regard that this paper also investigates security management in rural and urban settings; the investigation culminates with the role of the space syntax of a built environment plays in security management.*

Keywords: Crime prevention, security management, Space Syntax analysis, Urban design

1. Introduction

Crime in its simplest definition can be said to be an unlawful activity punishable by a governing authority. Crime is a serious situation that if not handled correctly has the strong potential to threaten the existence of a society (Canter & Youngs, 2016). However, the definition of crime varies from one society to another depending on the history and worldview of such societies (Sowmyya, 2014). Certain types of crimes are legal and not punishable, they are known as self-defense (Sowmyya, 2014).

Crime usually occurs more frequently in densely populated areas than in sparsely populated areas; in urban settings that have dense populations, a nonlinear relationship exists between crime rate and population size (Oliveira, 2021). There are three perspectives of crime as shown in Figure 1 from which crime can be studied. These perspectives give a unique assessment of crime.

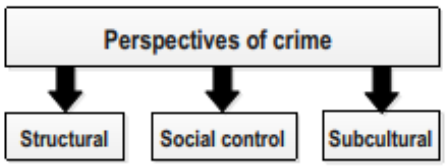

Figure 1: Three perspectives on crime
Source: Oliveira (2021)

The structural perspective of crime deals with structural criminology. This is a sociological approach to criminology in which an analysis of the relationship between race and classes of people is undertaken to establish some basis for the cause of crime. This situation is usually exacerbated when they are an increase in the frequency of interaction between people as a result of an increase in population (Oliveira, 2021; Siegel, 2000). According to Amonie/Strain theory, the structural perspective of crime can be traced to the cultural goals of society (e.g. wealth, status), and the structural means by which such goals can be achieved (University of Glasgow, 2016). The social control

perspective of crime proposes the idea that a correlation exists between population size and the quality of social relations; this correlation could translate into an inhibition for crime or otherwise (Oliveira, 2021). The social control perspective of crime can also be viewed as self-help which is a unilateral act of aggression by a person or group of persons (Black, 1983). The subcultural perspective holds the view that the concentration of the population causes the convergence of individuals with shared values which in turn creates private social networks with which these individuals associate themselves (Nwalozie, 2015). Private social networks which can be referred to as subcultures are usually the framework by which different types of behaviors are enabled which increases the likelihood of the occurrence of crime (Oliveira, 2021).

2.0 Crime-causing factors in society

Different types of crime occur in a society, and for each of these, several factors are responsible for their occurrence. In the literature, three main factors have a strong influence on the occurrence of crime. This section provides an overview of these factors.

2.1 Economic Factors

Economic factors have been identified in the literature as one of the main causes of crime. A major economic factor that has been identified as one of the critical causes of crime is income disparity (Onyeneke & Karam, 2022). Other factors include income disparity/deprivation, unemployment, and education level (Buonanno, 2003). These factors cause social dislocation which leads to maladjustment in families, social vices, and susceptibility to negative influences. In the context of income disparity, low income heightens the possibility of crime from the perspective of the criminal because they expect fractional losses in legitimate income through the acquisition of criminal records (Buonanno, 2003).

A strong link exists between crime and unemployment when one looks at criminal activities as a form of employment from a criminal's perspective; the criminal activity generates income for the unemployed criminal just like the way a legitimate activity generates income for a law-abiding citizen (Raphael & Winter-Ebmer, 1998). According to (Papps & Winkelmann, 2000), the influence of employment on the occurrence of crime is to the degree that it should be considered non-pecuniary. In furtherance of this line of thought, low-income growth has been linked to unemployment which then causes a higher rate of crime (Anser et al., 2020). On the reverse side, a study conducted that analyzed crime rates in the 1990s revealed that the significant crime reduction that occurred during that period was attributable to the reduction in the unemployment rate during the same period (Raphael & Winter-Ebmer, 2001).

Education is a potential tool for the reduction of crime rates as it equips whole populations with the necessary skill set to legitimately earn a living. Education level has been shown to have different effects on the rate of crime among different racial groups (Groot & Maassenvandenbrink, 2010). As an example, in the US, the secondary level of education reduces the probability of a jail sentence by 0.76 percentage points among white people, and 3.4 percentage points among black people (Groot & Maassenvandenbrink, 2010). Education level has a directly proportional relationship with the level of legitimate income, and an inversely proportional relationship with the cost of illicit behaviour (Lochner & Moretti, 2004). As a result of this, individuals with high education levels usually show a low propensity for crime and are more averse to risks.

2.2 Environmental factors

Environmental factors predispose a society to crime because of the vulnerability they implicitly infuse into a society. Three main factors which are known to have the most significant impact in making society susceptible to crime include natural disasters, poor building plans, and poor neighbour layouts.

Natural disasters are known catalysts for the rapid breakdown of social order which spurs people to crime due to desperation. The propensity to commit a crime in the event of natural disasters is propelled by the abandonment of houses and business premises (Roy, 2011). An example of this was in 2008 when floods hit the Indian state of Bihar (Roy, 2011). In neighbourhoods with high population density, the occurrence of natural disasters triggers a sudden shortage of basic social services and consumables; this in turn creates an atmosphere of unhealthy competition for whatever is left; the result is the breakdown of law and order which leads to crime (Kwanga, Shabu, & Adaaku, 2017). Gender-based crime has recently been identified as a form of crime which occurs during and after natural disasters. This form of crime which thrives because of the failure of law enforcement following a natural disaster exposes women and girls to increased life stressors, high-risk environments, and sexual exploitations (Thurston, Stöckl, & Ranganathan, 2021).

Poor building plans are known to increase the possibility of crime, especially burglary because they fail in the creation of defensible space in the design stage of buildings. This situation is completely avoidable as building plans are a potent tool for the prevention and reduction of crime that occurs in houses and offices (Ebong, Zubairu, & Olagunju, 2017). The plan of buildings especially public buildings which have higher traffic than residential buildings have a central role to

play in the prevention of crime that may occur within them (Holzman, Kudrick, & Voytek, 1996). A known technique that can be deployed at the design stage of such buildings is space syntax analysis using the isovist characterization of the building plans (Sengke & Atmodiwirjo, 2017; Tarabieh, Nassar, Abdelrahman, & Mashaly, 2018; Wiener et al., 2007). Space syntax analysis makes it possible at the design stage to determine the visibility of different parts of a building from a point of interest; this is very important in designs that are done for crime prevention.

Poor neighborhood layout is arguably the most significant environmental factor that causes crime. This is because neighborhoods' geographical frames of reference encompass the ecologic, economic, and demographic characteristics of a particular place (Wilson, Brown, & Schuster, 2009). Hence, every neighborhood can be identified by a unique underlying geography which has a strong link to the occurrence of crimes that are likely to occur there. A neighborhood with a poor layout will naturally increase the likelihood of crime; this can be minimized through the concept of Crime Prevention Through Environmental Design (CPTED). CPTED encapsulates several ecological crime theories that state that crime can be permitted or prevented by features of the physical environment which could be natural or man-made (Cole, 2019). Man-made features like the built environment can be designed in such a way that crime will be inhibited; one effective way of realizing such designs is through space syntax analysis of neighborhood layouts.

3. Security management techniques

Security management techniques are the aggregation of activities designed to reduce or prevent the occurrence of a crime. The series of activities could be to achieve a proactive management of security or a reactive management of security. The proactive approach involves the construction of high walls, electric fences, spikes, and CCTV cameras. This arrangement applies to public buildings and residential buildings, and in many cases, common occurrences of crime like petty theft and burglary have been effectively mitigated by these measures (Marks & Overall, 2015).

In public buildings where the possibility of crime is high, most organizations have developed an Integrated Security Management System (ISMS). The ISMS classically has three components- the physical, electronic, and procedural components (Kassan & Muiya, 2021). The physical component comprises high walls and electric fences as mentioned earlier. The electronic component comprises sensors, CCTV, and intruder alarm systems. The third component comprises guidelines and policies for the effective operations of ISMS (Kassan & Muiya, 2021). Security challenges differ by their nature and frequency in urban and rural areas. As a result, differences are bound to occur in the management of security in urban and rural areas. The following sub-sections briefly discuss the management of security in these areas.

3.1 Security management in urban areas

Urban areas are characterized by high population densities and frequent interaction between people of different shades who in most cases have no historical connection with each other, and whose interaction with each other is happenstance; As indicated in the literature, affluent parts of urban areas usually make arrangements with government law enforcement agencies to provide special security coverage (Nwokaeze, Ikiriko, & Johnbull, 2022); such an arrangement has been shown to effective in reducing the possibility of crime. Another approach used for the management of crime in urban areas is the concept of neighborhood watch (Holloway, B, & David, 2013); this approach is effective in reducing the incidences of burglary and car theft. In urban areas in places like the UK, the concept of neighborhood wardens has been implemented to further boost security in urban areas; these wardens are primarily responsible for the security of their neighborhoods, and they are usually the first responders in the event of a crime in their area of responsibility (Jacobson & Saville, 1999). In some neighborhoods in urban areas where the majority of residents have the same security concerns, perimeter walls also called Jericho walls are usually erected around the neighborhood; this gives the entire neighborhood a first line of defense against criminals (Bako, Bello, Abdulyekeen, & Balogun, 2018; Nwokaeze et al., 2022; Schneider & Kitchen, 2017).

3.2 Security management in rural areas

Rural areas differ from urban areas in several contexts which include demography, culture, and administration. These differences strongly influence how rural areas manage crimes. A key component of crime management in rural areas is an informal police structure also called vigilante which is saddled with the responsibility of preventing crime and arresting criminals for prosecution (Chikwendu, Nwankwo, & Oli, 2016). In advanced countries like the US, rural areas organize themselves in outcome-focused prevention planning schemes that proactively anticipate the type of crimes that are likely to occur in communities and take steps to prevent their occurrence; this approach guarantees cost-effective management of crimes (Ceccato, 2017).

In developing countries, rural areas are usually characterized by poverty and food insecurity. A unique type of crime that occurs in this type of setting is agriculture-based crime i.e. food theft which could be

pre-harvest or post-harvest (Arisukwu et al., 2020; Herrera et al., 2021). To manage this type of crime, inter-community coordination between vigilante groups in a rural area is usually created to achieve proper surveillance of the movement of agricultural products (Anadi, 2017). The awareness of this kind of arrangement has a strong mitigating effect on the possibility of food theft as a crime.

4. Role of Space Syntax Analysis of Built Environment in Security Management

Security management as a key component for the well-being of society has been shown in the preceding section to have received a lot of attention. One area in which attention has not been adequately given is the use of space syntax analysis in the design of the layouts of buildings, neighborhoods, and communities, especially in urban areas. As a technique, space syntax is used for the analysis of the spatial morphology of architectural designs to determine their visibility index, safety, and functionality (Dettlaff, 2014; Minnery & Lim, 2005; Newman, 1972). The application of space syntax in architectural designs will significantly reduce the possibility of crimes ab initio because the spatial morphology in the designs at the building, and neighbourhood levels will make it difficult for crimes to be committed successfully. An established technique in space syntax analysis is the Isovist analysis (Sengke & Atmodiwirjo, 2017; Wiener et al., 2007; Xiang & Papastefanou, 2019).

Architecturally, an isovist is the volume of space which is visible from another point in space. Isovist analysis can be performed in building designs and neighbourhood designs. It gives architects the ability to ensure that spaces within their designs meet the requirements which will guarantee a low level of crime. As an example, consider the Isovist analysis of the second floor of annexe 1 of the federal secretariat Abuja shown in Figure 2. Isovists 1, 5, and 9 have poor integration; hence, the occupants of these Isovists will experience poor mobility. Isovists 6, and 8 have better integration than the previous Isovists; better comfort in terms of mobility will be enjoyed by the occupants of these Isovists. Better integration can be observed in Isovists 3, 4, and 7 which show good integration and good mobility for the occupants; hence, the occupants enjoy the best mobility. Table 1 shows the spatial analysis for annex 1 – second floor of the federal Secretariat Abuja in terms of connectivity, point first moment, and point second moment.

From the values obtained in Table 1 and the Isovist analysis of Figure 2, an architect can review the design and subject it through repeated analysis after making necessary adjustments to achieve the desired results.

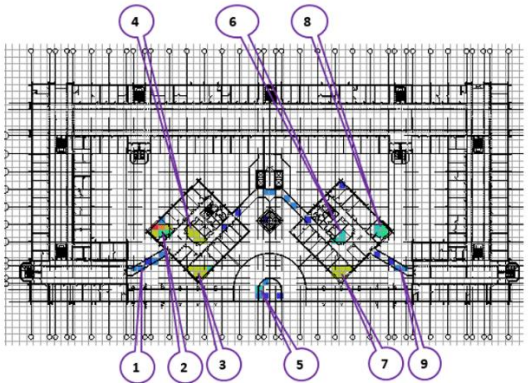

Figure 2: Federal Secretariat Annex 1 – 2nd floor
Source: Field survey (2020)

Table 1: Visibility graph analysis for annex 1- 2nd Floor of the Federal Secretariat Abuja

Isovist number	Connectivity		Point First		Point Second	
	Min value	Max	Min	Max	Min	Max
1	0	1	0	0.2828	0	0.08
2	1	6	0.2828	1.8128	0.08	0.6
3	2	4	0.73	1.33	0.2	0.48
4	4	4	0.9656	1.4957	0.24	0.64
5	0	2	0	0.4828	0	0.12
6	2	2	0.4	0.4828	0.08	0.12
7	4	4	0.8828	1.33	0.2	0.48
8	2	3	0.4828	0.6828	0.12	0.16
9	0	1	0	0.2	0	0.04

Source: Field Survey (2020)

Conclusion

Crime and security management are an integral part of a society that hopes to develop and attract investments. This paper has been able to review crime in the context of human society, and the factors which are primarily responsible for the occurrence of crime. The paper also looked at the management of crime in urban and rural areas within the peculiarities of their demographic and cultural realities. The paper was to show that in urban areas, the management of crime is more complex because of the multicultural nature of cities. The paper then paid special attention to the application of space syntax analysis in the management of crime. Through an example of the use of Isovists to perform visibility analysis of buildings and neighborhoods, space syntax analysis was shown to be very central in performing architectural designs which makes the management of crime effective right at the initial design stage.

References

Anadi, S. K. M. (2017). Security and Crime Prevention in Under-Policed Societies: The Experiment of Community Vigilantism in Anambra State of

Nigeria, West Africa. *Journal of Law, Policy and Globalization*, *60*, 122–129.

Anser, M. K., Yousaf, Z., Nassani, A. A., Alotaibi, S. M., Kabbani, A., & Zaman, K. (2020). Dynamic linkages between poverty, inequality, crime, and social expenditures in a panel of 16 countries: two-step GMM estimates. *Journal of Economic Structures*, *9*(43), 1–25. https://doi.org/10.1186/s40008-020-00220-6

Arisukwu, O., Igbolekwu, C., Oye, J., Oyeyipo, E., Asamu, F., Rasak, B., & Oyekola, I. (2020). Community participation in crime prevention and control in rural Nigeria. *Heliyon*, *6*(e05015), 1–7. https://doi.org/10.1016/j.heliyon.2020.e05015

Bako, A. I., Bello, N. A., Abdulyekeen, A. O., & Balogun, F. A. (2018). A Review of Urban Residential Neighbourhood Security. *KIU Journal of Humanities*, *3*(3), 139–150.

Black, D. (1983). Crime as Social Control. *American Sociological Review*, *48*(1), 34–45.

Buonanno, P. (2003). *The Socioeconomic Determinants of Crime. A Review of the Literature* (pp. 1–33). pp. 1–33.

Canter, D., & Youngs, D. (2016). Crime and society. *Contemporary Social Science*, *11*(4), 283–288. https://doi.org/10.1080/21582041.2016.1259495

Ceccato, V. (2017). Crime prevention in rural areas: Youth-related challenges. In *Rural crime and community safety* (pp. 323–345). New York: Routledge.

Chikwendu, S. C., Nwankwo, I. U., & Oli, N. P. (2016). The Role of Vigilante Service Groups in Crime Control for Sustainable Development in Anambra State, South-East Nigeria. *Greener Journal of Social Sciences*, *6*(3), 65–74. https://doi.org/10.15580/GJSS.2016.3.101416161

Cole, S. J. (2019). Social and Physical Neighbourhood Effects and Crime: Bringing Domains Together Through Collective Efficacy Theory. *MDPI - Social Sciences*, *8*(147), 1–18. https://doi.org/10.3390/socsci8050147

Dettlaff, W. (2014). Space syntax analysis – methodology of understanding the space. *PhD Interdisciplinary Journal*, 283 291.

Ebong, S. O., Zubairu, S. N., & Olagunju, R. E. (2017). Factors Affecting Architectural Design for Crime in Nigeria: Role of the Architect. *Journal of Sustainable Architecture and Civil Engineering*, *1*(18), 19–26. https://doi.org/10.5755/j01.sace.18.1.17348

Groot, W., & Maassenvandenbrink, H. (2010). The effects of education on crime. *Applied Economics*, *42*(3), 279–289. https://doi.org/10.1080/00036840701604412

Herrera, J. P., Rabezara, J. Y., Ravelomanantsoa, N. A. F., Metz, M., France, C., Owens, A., … Kramer, R. A. (2021). Food insecurity related to agricultural practices and household characteristics in rural communities of northeast Madagascar. *Food Security*, (13), 1393 – 1405. https://doi.org/10.1007/s12571-021-01179-3

Holloway, K., B, T., & David, P. F. (2013). Does Neighborhood Watch Reduce Crime? *U.S. Department of Justice, Office of Community Oriented Policing Services*, (3), 1–46.

Holzman, H. R., Kudrick, T. R., & Voytek, K. P. (1996). Revisiting the Relationship Between Crime and Architectural Design: An Analysis of Data from HUD's 1994 Survey of Public Housing Residents. *Cityscape: A Journal of Policy Development and Research*, *2*(1), 107–126.

Jacobson, J., & Saville, E. (1999). Neighbourhood Warden Schemes: An overview. *Crime Reduction Research Series Paper 2*, pp. 1–58.

Kassan, P. L., & Muiya, B. M. (2021). Use of Integrated Security Management System in Crime Prevention a Case of Public Referral Hospitals in Nairobi City County, Kenya. *IOSR Journal Of Humanities And Social Science*, *26*(10), 53–73. https://doi.org/10.9790/0837-2610025373

Kwanga, G. M., Shabu, T., & Adaaku, E. M. (2017). Natural Disasters and Crime Incidence: A Case of 2012 Flooding in Benue State, Nigeria. *International Journal of Geology, Agriculture and Environmental Sciences*, *5*(5), 43–48.

LOCHNER, L., & MORETTI, E. (2004). The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self-Reports. *THE AMERICAN ECONOMIC REVIEW*, *94*(1), 155–189.

Marks, M., & Overall, C. (2015). Breaking Down Walls: New Solutions for More Effective Urban Crime Prevention in South African Cities. *International Journal of Security & Development*, *4*(1), 1–19. https://doi.org/10.5334/sta.es

Minnery, J. R., & Lim, B. (2005). Measuring crime prevention through environmental design. *Journal of Architectural and Planning Research*, 330–341.

Newburn, T. (2016). Social disadvantage, crime, and punishment. In *Dean, Hartley and Platt, Lucinda,* (pp. 322–340). Retrieved from http://eprints.lse.ac.uk/68133/

Newman, O. (1972). *Defensible Spaces: Crime Prevention through Urban Design*. New York:

Macmillan.

Nwalozie, C. J. (2015). Rethinking Subculture and Subcultural Theory in the Study of Youth Crime – A Theoretical Discourse. *Journal of Theoretical and Philosophical Criminology*, *7*, 1–16.

Nwokaeze, E. C., Ikiriko, T. D., & Johnbull, W. (2022). Urban Security Challenges: A Review of Crime Prevention Strategies Adopted by Residents in Greater Port Harcourt City, Rivers State, Nigeria. *International Journal of Research and Review*, *9*(3), 60–74.

Oliveira, M. (2021). More crime in cities? On the scaling laws of crime and the inadequacy of per capita rankings—a cross-country study. *Crime Science*, *10*(27), 1–13. https://doi.org/10.1186/s40163-021-00155-8

Onyeneke, C. C., & Karam, A. H. (2022). An Exploratory Study of Crime: Examining Lived Experiences of Crime through Socioeconomic, Demographic, and Physical Characteristics. *MDPI - Urban Science*, *6*(43), 1–17. https://doi.org/10.3390/ urbansci6030043

Papps, K. L., & Winkelmann, R. (2000). Unemployment and Crime: New Evidence for an Old Question. *New Zealand Economic Papers*, *34*(1), 53–71. https://doi.org/10.1080/00779950009544315

Raphael, S., & Winter-Ebmer, R. (1998). Identifying The Effect Of Unemployment On Crime. *The Journal of Law and Economics*, *44*(1), 259–283. https://doi.org/10.2139/ssrn.145790

Raphael, S., & Winter-Ebmer, R. (2001). Identifying the Effect of Unemployment on Crime. *The Journal of Law and Economics*, *44*(1), 259 – 283.

Roy, S. (2011). The impact of natural disasters on violent crime. *Working Paper*, pp. 1–38. Retrieved from https://www.nzae.org.nz/wp-content/uploads/2011/08/Roy__The_Impact_of_Natural_Disasters_on_Violent_Crime.pdf

Schneider, R. H., & Kitchen, T. (2017). The Tower of Jericho. In *Planning For Crime Prevention: A Transatlantic Perspective* (pp. 68–69). New York: Routledge.

Sengke, M. M. C., & Atmodiwirjo, P. (2017). Using Isovist Application to Explore Visibility Area of Hospital Inpatient Ward. *IOP Conf. Series: Earth and Environmental Science*, *185*, 1–7. https://doi.org/10.1088/1757-899X/185/1/012008

Siegel, L. J. (2000). Social Structure Theories. In *Criminology* (7th ed., pp. 184–219). Retrieved from https://www.ojp.gov/ncjrs/virtual-library/abstracts/social-structure-theories-criminology-seventh-edition-p-184-219

SOWMYYA, T. (2014). Crime: A Conceptual Understanding. *Indian Journal of Applied Research*, *4*(3), 196–198.

Tarabieh, K., Nassar, K., Abdelrahman, M., & Mashaly, I. (2018). Statics of space syntax: Analysis of daylighting. *Frontiers of Architectural Research*, *8*, 311–318. https://doi.org/10.1016/j.foar.2019.05.004

Thurston, A. M., Stöckl, H., & Ranganathan, M. (2021). Natural hazards, disasters and violence against women and girls: a global mixed-methods systematic review. *BMJ Global Health*, *6*(e004377), 1–21. https://doi.org/10.1136/ bmjgh-2020-004377

University of Glasgow. (2016). *Theories and causes of crime* (pp. 1–9). pp. 1–9. Retrieved from http://www.sccjr.ac.uk/wp-content/uploads/2016/02/SCCJR-Causes-of-Crime.pdf

Wiener, J. M., Franz, G., Rossmanith, N., Reichelt, A., Mallot, H. A., & Bulthof, H. H. (2007). Isovist Analysis Captures Properties of Space Relevant for Locomotion and Experience. *Perception*, *36*(7), 1066–1083.

Wilson, R. E., Brown, T. H., & Schuster, B. (2009). Preventing Neighborhood Crime: Geography Matters. *NIJ Journal*, (263), 30–35.

Xiang, L., & Papastefanou, G. (2019). Isovist and Psycho-Physiological Stress at the Pedestrian Level: A Real-Time Measurement Case Study in a High-Density City. *REAL CORP 2019 Proceedings*, 463–471. Tagungsband.