

## #196

### SPACE AND CRIME IN THE NORTH-AFRICAN CITY OF ANNABA:

Using space syntax to understand the strategy of offenders in the choice of location of street crime.

---

**DOUNIA LAOUAR**

Badji Mokhtar University, Annaba, Algeria  
laouar.d@gmail.com

**SAID MAZOUZ**

Arbi Ben Mhidi University, Oum El Bouaghi, Algeria  
mazouz\_dz@yahoo.fr

**AKKELIES VAN NES**

Delft University of Technology, Delft, Netherlands  
a.vannes@tudelft.nl

---

#### ABSTRACT

This paper describes the preliminary results of a PHD research study conducted in Annaba city. Annaba is one of the un-safest city in Algeria, due to high occurrence of street crime.

The study investigates the relationship between space and crime by using space syntax. The aim is to describe the spatial characteristics of the built environment and the spatial distribution of crime pattern. The space syntax variables are connected to the statistical data on street crime data registered in Annaba.

This inquiry seeks to identify the spatial features of the crime locations to understand the relationship between the spatial configuration and crime behaviour. Most studies on space and crime in European cities deal with burglars and auto-theft. However, this inquiry focuses on two types of street crime, occurring frequently in urban open public space of Algerian cities, namely snatch theft and mugging. Therefore, the results from space syntax analyses of Annaba' street network is made and put into GIS. Likewise, a crime registration map was generated in GIS to visualize the overall distribution patterns of crime. This map is correlated with various space syntax measures.

Most European studies on space and crime shows that crime takes place in the more segregated and poorly connected streets. However, the finding of this research shows that the more integrated and well-connected and controlled streets are, the higher numbers of snatch theft and mugging. One explanation might be that segregated streets tend to have no potential victims, and hence, it affects the numbers of snatch theft and mugging.

#### KEYWORDS

Spatial Configuration, Street Crime, Axial Analysis, Urban Morphology

## 1. INTRODUCTION

What are the spatial features of the built environment where snatch theft and mugging takes place? Annaba is a mid-sized city in the North East of Algeria with 257 359 inhabitants. The city is considered among the un-safest city of the country, where it has been recorded 9,5 offences per 1000 inhabitants in 2008.

Current crime theories have long presumed that criminal incidents are closely linked to the physical environment. The results of those theories can be resumed as following:

- There are researchers that consider urban space shape criminal offence opportunities. According to these theories crime takes place on a criminal's daily routine activity and rational choice of opportunities taking place in a built environment (Brantingham&Brantingham, 1993).
- There are researchers focusing on certain spatial aspects on the physical environment that generates fear for crime. Examples on this are the prospect and refuge theory (Fisher, Nasar, 1992).
- Recently, research projects based on space syntax methodology, are examining the relationship between the spatial configuration of urban space and the occurrence of criminal events (Alford, 1996; Hillier, 1998; Shu, 1999; Hillier & Sahbaz, 2005; Nubani&Wineman, 2005, van Nes & López, 2010).

This on-going research project intends to investigate how crime patterns occur in certain areas, and not in other, in an Algerian city context. The aim is to analyse the spatial features through space syntax of the physical environment's crime location and how the occurrence of a criminal incident constitutes itself the criminal offence opportunity by employing statistical analysis of every dimension measured.

## 2. DATASETS AND METHODS

We could not get access to the confidential police data on crime for Annaba. Therefore we conducted a victimization survey through a questionnaire addressed to 704 randomly chosen inhabitants of the city. Where the interviewees mentioned if they were or they have been witness of any kind of victimization in the period of the last three years, we asked them to localize the incidence on a map. The survey reveals that more than 53% of respondents have been victimized or have been witness of victimization. Through this survey, we managed to map the spatial location of each specific criminal incident and not on where people feel unsafe through rumours. Thereby, the crime occurrences were mapped in GIS to observe the overall distribution patterns of the offences before they were linked to the syntactical analysis measures.

Only the analyses of the snatch thefts and mugging are presented in this short paper. Those offences events represent the most recurring offences reported by the interviewees, which represent respectively 35% and 20% of all crime registered.

Moreover, a geo-referenced axial map of the whole city was made in GIS. The results from space syntax analyses of Annaba's street network are imported into GIS. Figure 1 shows the distribution of global integration values and the distribution patterns of both of the street crime analysed.

The occurrence of thefts and mugging are correlated with a various space syntax measures. In this case, we focused on those related to accessibility measurements.

In order to verify the effect of the co-presence on the occurrence of the two type of street crime, we observed pedestrian flow rates at 41 gates (Figure 2), distributed in several streets of the city, which includes both safe and unsafe streets. The gate counts measure the number of people that cross the street during a given time interval. The movement measure reported in the analysis refers to the number of people per minute and is average from 8 observations taken

at different time of the day. Those data have been correlated with the street crime registration to check any possible relationship (Correlations improve when we take the logarithm of people per minute).

### 3. RESULTS

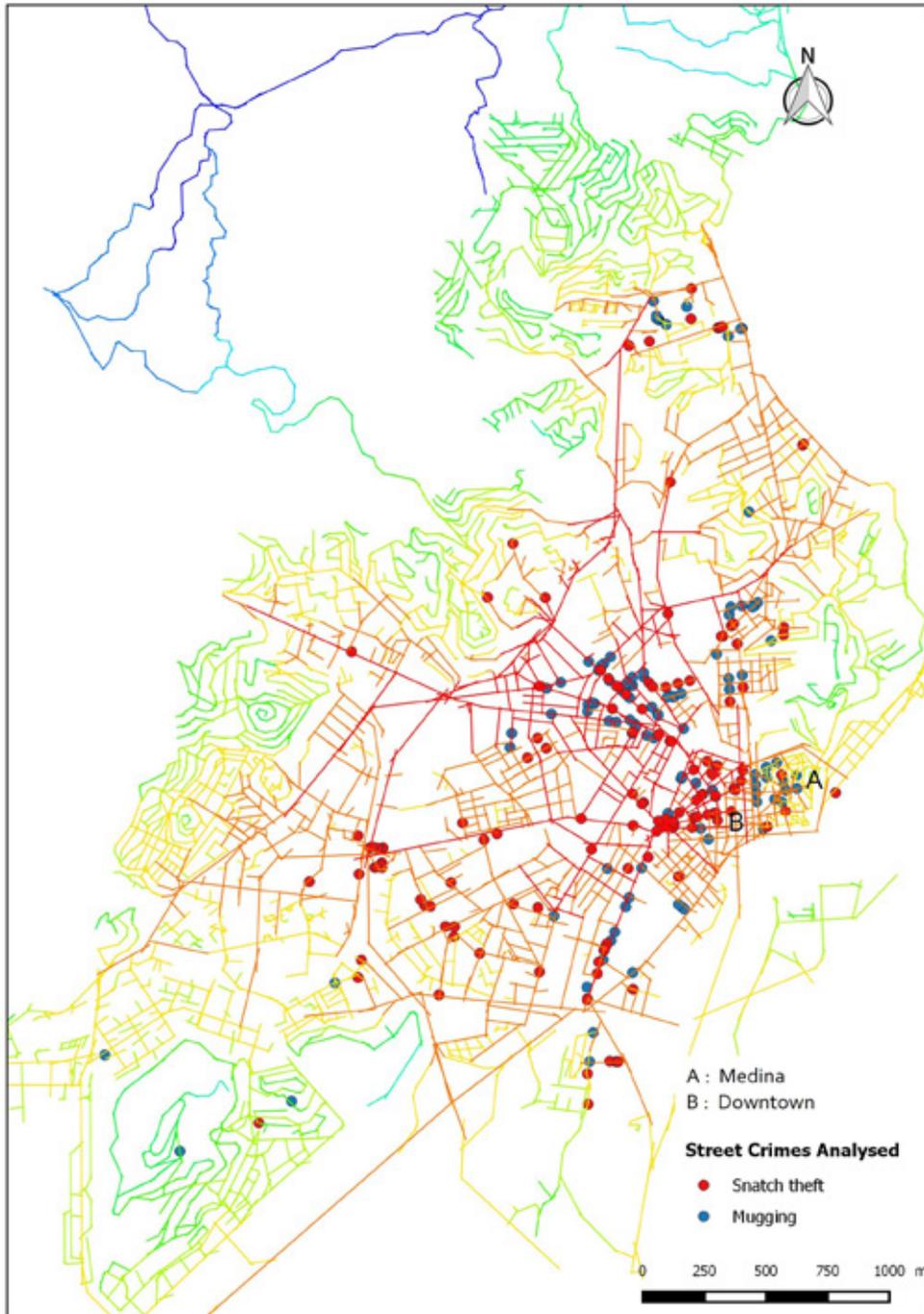


Figure 1 - Global integration map and the registration of snatch theft and mugging.

The findings indicate that both snatch theft and mugging takes place mostly during the day in integrated urban areas in highly frequented and trafficked streets with shoppers (in the time period from 12:00 to 20:00). The spatially highly integrated streets have also the highest pedestrian flow rates according to the registrations.

As the registration and spatial analyses show, the snatch theft rate is much higher than the mugging rate. Both of them tend to cluster in a linear way around the highly globally integrated, and well-connected streets (Figure 1). These streets are the commercial busiest streets in the city's downtown, creating what Hillier & Sahbaz called 'hot lines' (2005, p.458). However, these incidents also take place in the boarder areas separating the integrated districts from the segregated ones. Next to the commercial streets there are several opportunities for the offenders who are operating in the downtown area to escape into the Medina area. Since most offenders know the spatial opportunities for the downtown area very well, they seems to be aware of the spatial as well as the temporal opportunities of what this built environment offer.



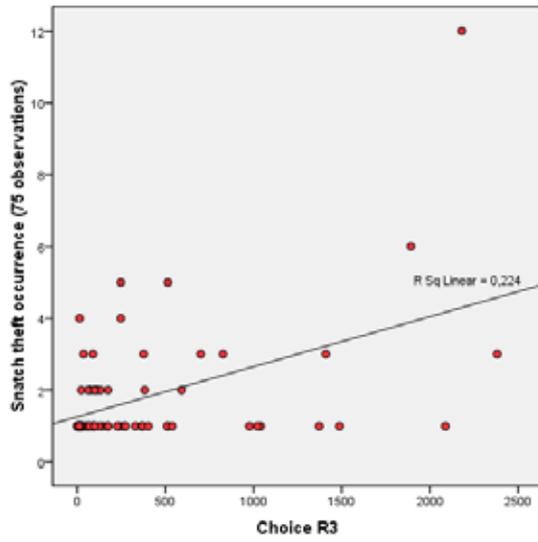
Figure 2 - Location of the observation gates in the city of Annaba

Statistical analysis of the correlation between spatial parameters and street crime occurrences were made. The following findings can be revealed in figure 3:

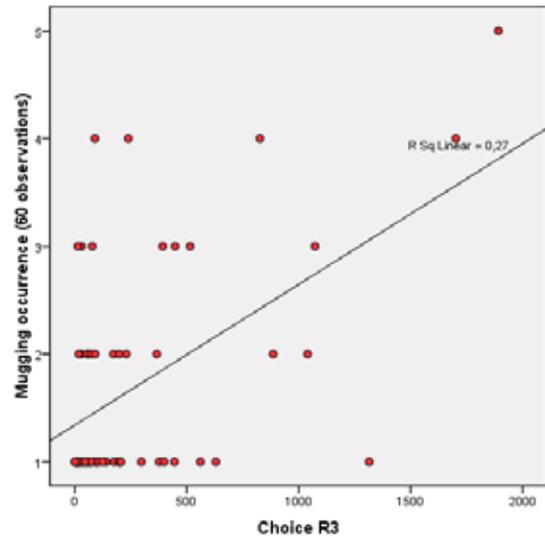
There is a clear correlation between the occurrence of street crime and the streets' degree of spatial integration. The variable of the choice  $R_3$  is the one who correlates best in both street crimes. We find there respectively for mugging  $r = 0.52$ , and snatch theft,  $r = 0.47$ . This local dynamic measure with radius 3 inform about the degree of probability that the location where these crime events occur are situated on the shortest topological routes.

The scatterplots and statistical data in the figure 3 below shows that snatch theft and mugging take place on the globally as well as locally highest integrated streets. Some gate counting was carried out for testing out the snatch theft and gate counting risk. As the results show, the higher spatial integration, the higher number of people in streets, and therefore, the higher availability of potential victims for snatch theft and mugging. Moreover, streets with high connectivity offer also several escapes routes, in particular when the integrated town centre is adjacent to a segregated low-income neighbourhood.

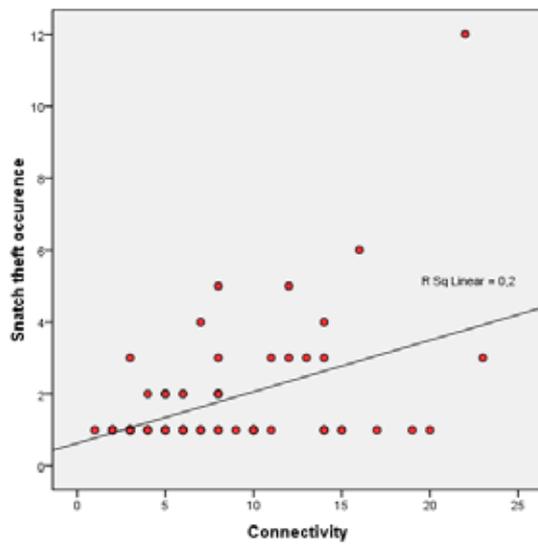
(A)



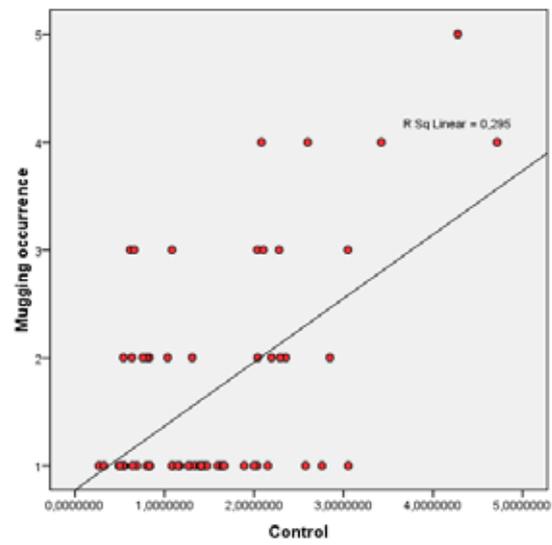
Pearson coefficient of correlation (r) 0.473(0.000)  
Regression R Sq=0.224



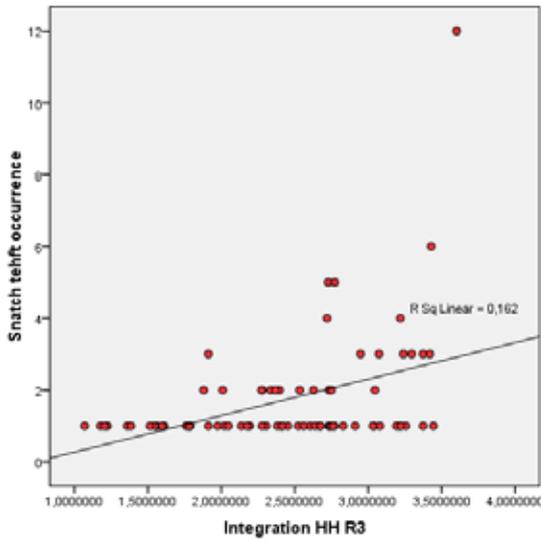
Pearson coefficient of correlation (r) 0.520(0.000)  
Regression R Sq=0.27



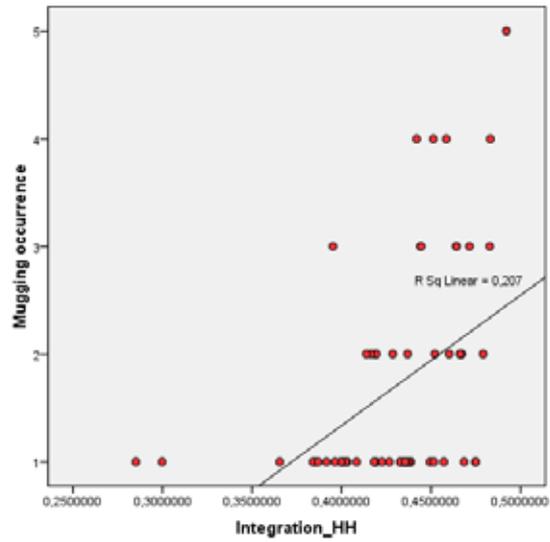
Pearson coefficient of correlation (r) 0.448 (0,000)  
Regression R Sq=0.20



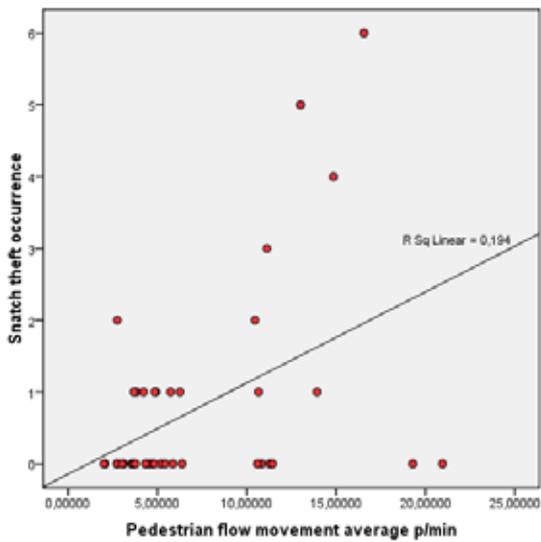
Pearson coefficient of correlation (r) 0.543 (0.000)  
Regression R Sq=0.295



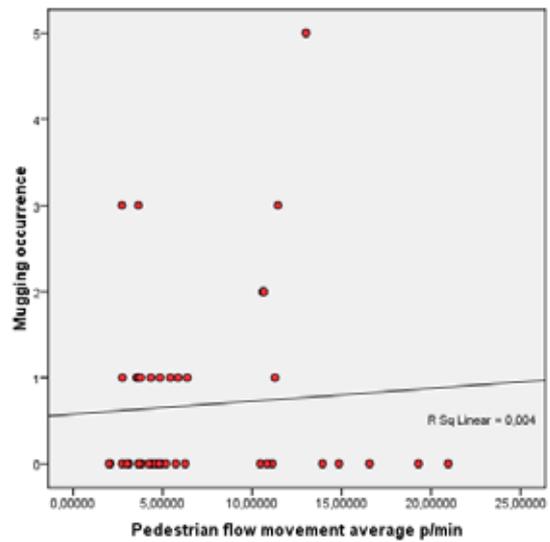
Pearson coefficient of correlation (r) 0.402 (0.000)  
Regression R Sq=0.162



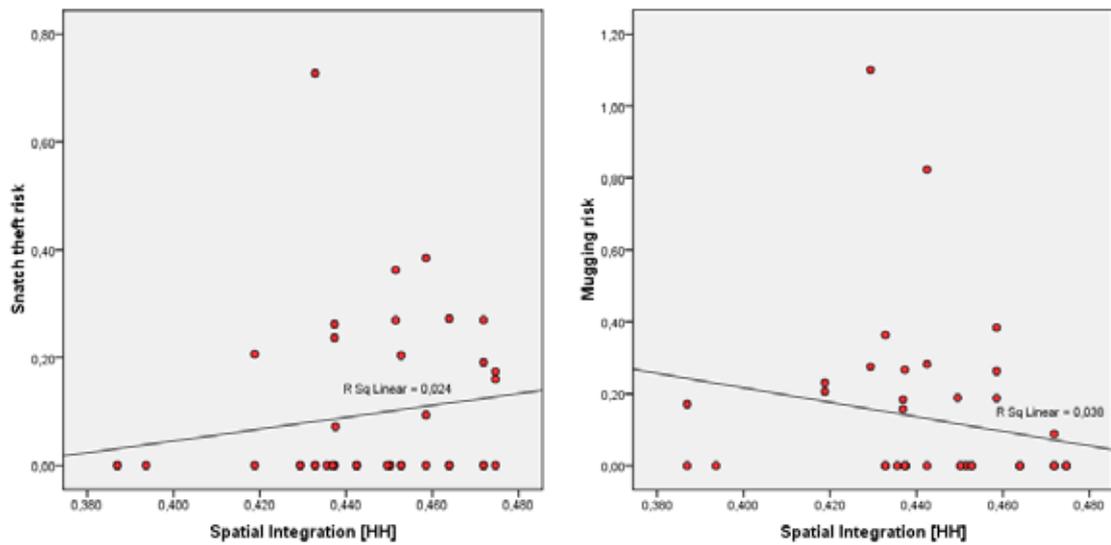
Pearson coefficient of correlation (r) 0.455 (0.000)  
Regression R Sq=0.207



Pearson coefficient of correlation (r) 0.441 (0.005)  
Regression R Sq=0.194



Pearson coefficient of correlation (r) 0.065 (0.688)  
Regression R Sq=0.004



Spearman Rho (r) 0.248 (0.118)  
Regression R Sq=0.024

Spearman Rho (r) -0.335 (0.03)  
Regression R Sq=0.038

Figure 3 - (A) Scattergrams showing the relationship between snatch theft and mugging occurrences and axial accessibility measures (Based respectively on 75, 60 axial lines where both street crimes are observed). (B) Scattergrams showing the relationship between snatch theft and mugging occurrences and pedestrian flow movement (Based on 41 axial lines where pedestrian flow was registered). (C) Scattergrams showing the relationship between snatch theft and mugging risk and global spatial integration (Based on 41 axial lines where pedestrian flow was registered).

In fact, offenders choose street segments with high local integration, because they are the most well-connected and shortest routes to all parts of the vicinity. This helps enormously the criminals in their strategies of escape, once when the act is done, or where in case there might be somebody to help to the victim.

The connectivity variable seems to influence the snatch theft ( $r:0.44$ ). This variable informs about the degree of connection of the space where these acts occur and the surrounding spaces. The connections relate to information to accesses and egress as regards the potential escape routes (Hillier & Sahbaz 2005, p.456). So, these roads could be used to access and to escape for the offenders.

The episodes of snatch theft seem related to the local integration HH R<sub>3</sub> variable,  $r 0.40$ . These criminal acts occur more in the most locally integrated street.

The results of the correlations between the 41 points of movement registration and the occurrence of street crime on those segments show the following results:

Pearson rank's correlation coefficient of the relationship between the average flow of people per minute and snatch theft shows  $0.44$   $p < 0.005$ . There is no significant relationship with mugging.

The degree of crime risk is calculated by dividing the degree of snatch theft and mugging incidences with the average of the pedestrian flow movement observed in 41 counting gate. The Spearman rank's correlations of those risks with the spatial integration show a radius- $0.335$  with the mugging incidences and no significant result with the snatch theft incidences. The more streets are integrated, the lesser the real risk to be mugged is present. We can also observe that the risk of being victim of snatch theft still is high in the highly frequented commercial streets.

The more streets are frequented by people the more they are vulnerable at snatch theft. Besides, frequent used streets have no impact on the production of the various acts of mugging. Indeed, Brantingham and Brantingham (1993) suggest that some type of crime, such the theft seem typically to cluster together along the busiest streets (Friedrich. E, Hillier. B, Chiaradia, 2009).

This results seem opposed to the recommendations of Jacobs (1961), who by the principle of the natural surveillance assured by the pedestrians, stipulates that the safety reigns in the busiest streets and that it is the opposite in the deserted one.

#### 4. CONCLUSIONS

To conclude, streets characterized by the presence of street crime events, namely snatch theft and mugging, appears in highly integrated, permeable and accessible streets. The main routes network in a city has these kinds of spatial features. As resulted, this spatial configuration increases the risk of being a victim of one of those street crime and which allow for several escape route possibilities for the offenders.

Besides, integrated and busy urban areas located adjacent to segregated areas shape opportunities for high crime risk. Offenders operate and find the opportunities in the integrated areas where a high number of potential victims frequent. The segregated areas offer several escape route possibilities by using the short well-connected routes between these two areas. The benefit of the closeness between these two areas, and the local knowledge of the offenders of the spatial opportunities of the neighbourhood for escape possibilities, correlates with the routine activity and the rational choice theories from the writings from environmental criminology.

High movement or co-presence of people is a necessary generative attractor for commercial activities. Likewise, a high number of people in streets function also an attractor for the potential offender searching for opportunities. Indeed understanding the strategy of the offenders to carry out a certain types of street crime, can contribute to some extend to plan safer built environments.

## REFERENCES

- Alford, V., (1996), 'Crime and Space in the Inner City', *Urban Design Studies*, 2: 45-76.
- Baran, P.K. & Smith, W.R. & Toker, U., (2007), 'The space syntax and crime: evidence from a suburban community', *Proceedings, 6th International Space Syntax Symposium, Istanbul*, 1:119.1-119.6.
- Brantingham, P. L. & Brantingham, P. J. (1993), 'Nodes, paths and edges: considerations on the complexity of crime and the physical environment', *Journal of Environmental Psychology*, no. 13, pp. 3-28.
- Cohen, L.E. & Felson, M., (1979), 'Social Change and Crime Rate Trends: A Routine Activity Approach', *American Sociological Review*, 44, 588-608.
- Cornish, D. & Clarke, R.V., (1986), 'The Reasoning Criminal', Springer-Verlag, New York.
- Fisher, B. & Nasar, J. (1992). 'Fear of crime in relation to three exterior site features', *Environment and Behaviour*, no. 24, pp. 35-65.
- Friedrich, E. & Hillier, B. & Chiaradia, A., (2009), 'Anti-social Behaviour and Urban Configuration Using Space Syntax to Understand Spatial Patterns of Socio-environmental Disorder', in D. Koch, L. Marcus, J. Steen (Ed.), *Proceedings, 7th International Space Syntax Symposium*, Stockholm: KTH, 1:34.1-34.16.
- Hillier, B. (1988). 'Against enclosure'. In: eds Teymur N, Markus T & Wooley T: *Rehumanising Housing*, Butterworths, London, pp. 63-85.
- Hillier, B. (1996), *Space is the Machine*, Cambridge University Press, Cambridge (MA).
- Hillier, B. & Sahbaz, O., (2005), 'High Resolution Analysis of Crime Patterns in Urban Street Networks: an initial statistical sketch from an ongoing study of a London borough', in: van Nes, A., *Proceedings Space Syntax. 5th International Symposium*, TU Delft, Techne Press, Delft.
- Jacobs, J., 1961, *The Death and Life of Great American Cities*, Penguin, London.
- Van Nes, A. & López, M.J.J., (2010), 'Macro and Micro Scale Spatial Variables and the Distribution of Residential Burglaries and Theft from Cars An investigation of space and crime in the Dutch cities of Alkmaar and Gouda', *The Journal of Space Syntax*, Vol 1, no: 2, pp: 296-314.
- Nubani, L. & Wineman, J., (2005), 'The Role of Space Syntax in Identifying the Relationship Between Space and Crime', A. van Nes (Ed.), *Proceedings, 5th International Space Syntax Symposium*, Delft, 413-422
- Shu, S., (1999), 'Housing Layout and Crime Vulnerability', F.R.B. Holanda, L. Amorim, F. Dufaux (Eds.), *Proceedings, 2nd International Space Syntax Symposium*, Brasilia, 1:25.1-25.12.