

# APPLICATION OF SPACE SYNTAX ANALYSIS IN LALBAGH

## *Exploring The Links Between Spatial Analysis And Drug Crime Pattern In Selected Streets Of Lalbagh, Dhaka*

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### ABSTRACT

Drug crime is an urban problem, and in Lalbagh, its occurrence is fairly common. It can nevertheless be prevented with surveillance, a feature of urban design. Spatial studies and criminology enable us to know significantly about where and why crime occurs. Criminals are rational individuals and they weigh risks and opportunities. A direct correlation can thus be found between the following variables: 1. Risk & Opportunity and 2. Physical Implications of Urban Design which includes spatial attributes. The aim of this paper is to identify the spatial attributes of a major drug crime location (Lalbagh) for helping urban planners, designers and crime control authorities to identify crime zones easily for acting “proactively” rather than “reactively” to the crime. While designing or examining neighbourhoods, for high values of Integration, Integration R=3 and Integration R=10 and Connectivity of an area, we can predict that area to be less crime-prone; because with higher levels of movement, levels of co-presence and co-awareness are expected to be higher. Based on this principle, selected streets of Lalbagh have been studied. Out of the other smaller streets of Lalbagh, Road 10, Shahidnagar was found to be particularly prone to criminal activities and this paper is focused on finding out the reasons behind it, on the basis of space syntax analysis. Depthmap software has been used as a tool to analyze and explain this pattern of drug crime.

**Key words:** Urban Morphology, Space Syntax, Criminology, Drug Crime, Old Dhaka, Urban Design.

### 1.0 INTRODUCTION

Crime is a predominant urban problem blamed for the decline of “quality of life” in urban settings. The focus is now shifting from deterrence to prevention of crime. Since criminals are rational individuals, they weigh risks and opportunities; hence Fanek and Jones (1997) assume a direct correlation between the following two variables: 1. Risk & Opportunity and 2. Physical Implications of Urban Design. [1] According to “Criminometric Models” in Quantitative Criminology, criminals act rationally and they weigh expected costs vs expected gains. Expected costs of crime include the following: 1. Opportunity costs and 2. Expected time in prison (if arrested). Crime prevention is, therefore, possible through designing physical attributes of the environment. Organising neighbourhood watches is a plausible approach, according to Charles Moore,

while other theories such as Oscar Newman’s “Defensible Space” and Jean Jacobs’ “Eyes on the Street” also recognise the importance of surveillance as an effective measure of crime prevention.

Applications of theory and research based on Space Syntax can enhance a range of environments. Designed circulation patterns can improve levels of social interaction and “surveillance”. As mentioned earlier, raised social physical interaction will discourage criminals (rational individuals who calculate risk and gain) to commit crime.

Crime like drug dealing in public places such as the streets of Lalbagh is a widespread phenomenon. According to Mamun and Nilufar (2015), street accessibility, proximity to specific land use, the number of intersections that need to be crossed to reach a street at a local level has a significant effect

on the locational choice of drug dealing. Rational choices (to movement) of streets and mixed-use residential areas with close proximity to poorly integrated streets show more vulnerability for becoming drug-selling point. Also, the streets having drug crime record show an inverse relation between streets control value and weighted choice value at local level. [2] While it is clear that spatial attributes are important to study in order to predict the possibility of crime occurrence, this paper focuses on investigating the spatial attributes of crime-prone streets in Lalbagh.

## 2.0 CRIME PATTERN AND SPACE

In the words of Charles Murray, *Common sense and everyday experience tell us that the physical environment is related to the risk of crime. That's why most people avoid poorly lighted streets and run-down neighbourhoods, thinking that they are more vulnerable targets in such places. This calculation about the specific chance of becoming a victim goes hand in hand with another common sense of understanding about crime: one of our best protections against crime is to live in a community where neighbours watch out for each other and stand ready to call the police or to intervene directly when they spot a malefactor.* [3]

While the above statement solidifies the relationship between spatial attributes and frequency of crime occurrence, other sources attempt to confirm and specify these spatial attributes: following are the key points extracted from P.L. Brantingham and P.J. Brantingham's paper on Crime Pattern Theory (2008). [4] [5]

- Criminals go through a sequence of daily activity and cross some routes on a regular basis and take decision whether to commit a crime.
- Usually, criminals do not function individually; they always try to be at groups of friends or family.
- Criminals commit crime finding triggering event within their daily routes.
- There is a limited range for every individual's daily activity, these comprise of workplace, markets, schools, mosques, hospitals and nodes between them.
- Criminals have a similar kind of spatial movement like a law-abiding person.
- Possible targets or victims usually have passive or

active activity space that shares the boundary of the offender and the occurrence of a crime depends on the will of the offender.

- Within the built urban form, crime generators are created by high flows of people through and to nodal activity points.

## 3.0 LITERATURE REVIEW

As discussed earlier, research has been conducted relating crime to spatial attributes of urban space in various places of the world. A research gap remains as to whether these spatial principles also apply to the unique scenario of Old Dhaka, particularly the labyrinthine street patterns of Old Dhaka. Lalbagh, home to the historic fort "Lalbagh Kella", is a significant part of Old Dhaka, rich with history, culture and heritage. Tabassum (2008) argues that spatial patterns suggest phase developments in both old and new domains of Dhaka, among which two distinct phases are clearly observed, Old Dhaka and New Dhaka, existing side by side. [6] According to Siddiqui et al (1991), Old Dhaka is the 'indigenous' historic core and New Dhaka is the 'informally' developed, extemporaneous settlement of recent years. [8] Nilufar (2004) adds that the historical core of Old Dhaka retains the traditional features of the urban settlement that it has inherited from the past and the natural endowment of its organic morphology is valued for its 'indigenous' urban pattern. [7] Thus, it can be an interesting research outcome if the street patterns of Old Dhaka can be studied with reference to human behaviour. Space syntax is a useful method to study the behavioural patterns of urban space in terms of "syntactic properties" such as integration, choice etc. [9]

In this paper, the crime of selling illegal drugs has been referred to as "drug crime". Drug crime has been chosen for analysis in this paper for the following reasons:

- Drug crime data is easily available.
- Drug crime is the most prominent crime in the selected area and it occurs in good numbers, and as such, the pattern for its locational choice has been identifiable.
- Streets are the major channels of movement and the most prominent public spaces. Since the task is to explore which street is the most vulnerable and why, drug crime has been chosen because it is the only crime occurring only on streets.

#### 4.0 AIM AND OBJECTIVES

The aim of this paper is to identify the spatial attributes of a major drug crime location for helping urban planners, designers and crime control authorities to identify crime zones easily so that they can act proactively rather than reactively to the crime. The main objectives are:

- To identify drug crime pattern in the streets of Lalbagh area that are under a single police station, from the data received from the police station.
- To identify the spatial attributes of the most prominent drug crime spots using space syntax.
- To analyze and compare these spatial attributes obtained from the simulation in the form of various syntactic properties and interpret the scenario on the basis of these values.

#### 5.0 METHODOLOGY

The methodology of this research can be termed as a case study, in order to examine the state of a presumed correlation, particularly the correlation between spatial configuration and the frequency of crime occurrence, in the specific case of Lalbagh, Dhaka. The method for establishing this correlation is Space Syntax, and for analysis, free software DepthMap has been used as a tool. Spatial layouts of urban spaces powerfully influence human behaviours such as the behaviour of criminals, which can be thoroughly analyzed by the science-based and human-focused approach called Space Syntax. [10] Jones and Fanek (1997) mentions with evidence that, while designing or examining neighbourhoods, for high values of Integration, Integration  $R=3$  and Integration  $R=10$  and Connectivity of an area, we can predict that area to be less crime-prone; since with higher levels of movement, levels of co-presence and co-awareness are expected to be higher. [1] Based on this principle, the data from DepthMap has been analysed to relate and compare crime data to “syntactic properties” of drug-crime-prone streets in Lalbagh, to check to what degree space syntax rules apply in this case.

#### 6.0 DATA FROM SURVEY AND SIMULATION

The drug crime data for January 2017 found in Lalbagh Police Station is numerically presented below in descending order with street names:

**Table 1.** Summary of Drug Crime Data, Lalbagh.

Arterial Roads		Street Branches	
Street Name	Drug Crime Occurrence	Street Name	Drug Crime Occurrence
Lalbagh Road	2	10, Shahidnagar	7
RND Road	2	4, Shahidnagar	2
Nababganj Road	2	1, Shahidnagar	2
New Paltan Line	2	2, Shahidnagar	1
Gangaram Bazar Lane	2	5, Shahidnagar	1
Azimpur Road	1	8, Shahidnagar	1
Beribadh Road	1	Haque Bakery	1
		Nababganj Park Road	1
		Nababganj Bazar Road	1
		13, Nababganj	1
		Sheikh Shaheb Bazar	1
		Koshai Road	1
		Ferdous Jame Mosque	1
		JN Saha Lane	1
		Lalbagh 3 BGB	1

**Source:** Lalbagh Thana Police Station.

It is important to mention here that the Arterial Roads are greater in length and are used as the main vehicular routes, and therefore cover more areas for drug crime to take place. Nonetheless, the statistics exhibit that these Arterial Roads are prone to far less crime occurrence with respect to their length superiority. Out of the other smaller streets, *Road 10, Shahidnagar* is evidently very prone to criminal activities and this paper is focused on finding out why, on the basis of space syntax analysis.

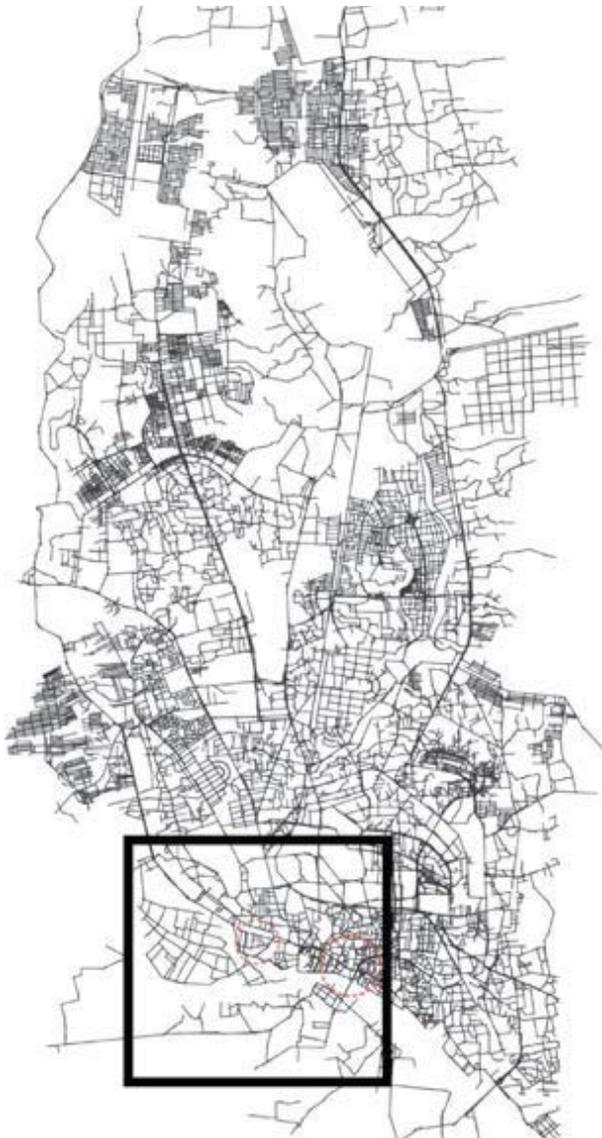


**Fig 1.** Area under Lalbagh Police Station. 1. Location of Road 10, Shahidnagar, 2 & 3. Police Checkpoints.



**Fig 3.** Road 10, Shahidnagar in the map.

Using Depth Map software, axial maps and syntactic values are generated for Lalbagh area with surroundings and analyzed and compared with the crime data.



**Fig 2.** Part of Dhaka city’s axial map used for analysis, Left and right circles denoting respectively the least and most integrated areas of Lalbagh



**Fig 4A.** Axial map and location of Road 10, *Shahidnagar*



**Fig 4B.** Brown Circle shows the location of the nearest Integration Core

Figure 4B shows that the nearest integration core is away from the study area denoted by the pink circle at the left. The study area, inside the pink circle, also appear to be consisting of the bluest (least integrated) lines, axial representation of *Shahidnagar* lanes. This locational choice for the selling of drugs can be easily explained from the crime data. Almost 43 percent of the alleged drug crime had been occurring in these lanes alone.



**Fig 4C.** Axial map with Integration R=n lines

Figure 4C shows that Road 10, Shahidnagar is more integrated than most of the roads to the left only. Figure 4D shows that this road comprises one of the least integrated lines (with the exception

of dead ends). Since Integration R=10 signifies vehicular movement[1], Road 10, Shahidnagar can be predicted to oversee one of the lowest amounts of vehicular movements. In fact, field observation indicates this road can barely provide space for two rickshaws crossing each other. Whereas vehicular movement is a limiting factor for crime occurrence, lack of vehicular movement, in this case, seems to be a driving factor of drug crime in streets.



**Fig 4D.** Axial map with Integration R=10 lines



**Fig 4E.** Axial map with Integration R=4 lines

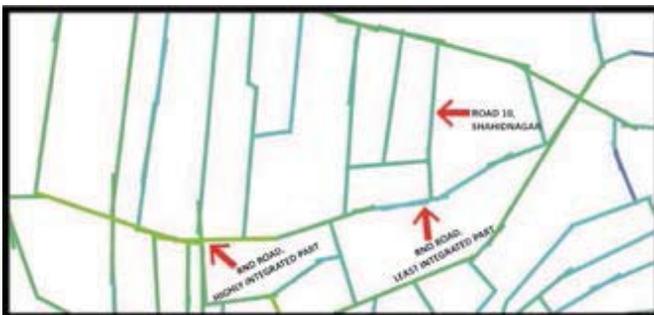
Figure 4D and 4E show that despite not being peripheral roads or dead ends, *Shahidnagar* lanes are clearly the least integrated within the system. Since Integration R=4 and Integration R=3 signify pedestrian movement, most *Shahidnagar* lanes,

including Road 10, *Shahidnagar* characterize the lowest pedestrian movements. A lack of pedestrian movement results in decreased surveillance and hence an increase in the crime rates.



**Fig 4F.** Axial map with Integration R=3 lines

Figure 4F illustrates a zoomed part of the axial map with Integration R=3 lines, which shows Road 10, *Shahidnagar* appearing to have been originated from the least integrated part of its nearest arterial road or mother road, *RND Road*. This implies that *RND Road*, being a principal route of movement for the neighbourhood, supports “high flows of people” needed to generate drug crime according to crime pattern theory, and drug selling is performed in Road 10, *Shahidnagar*, an area with “low movement” rates of pedestrians.



**Fig 5.** Axial map of *Shahidnagar* area

## 7.0 ANALYSIS AND INTERPRETATION

A brief statistical analysis of syntactic properties within the entire system is presented below:

Measure	Integration [HH] R3	Control	Choice R3
Average	1.88	1	66.55
Minimum	0.33	0.14	0
Maximum	3.88	3.46	3088
Standard Deviation	0.64	0.44	166.15
Avg. – Std. Dev.	1.24	0.56	< 0
Avg. value for RND Road’s least integrated part	1.31	1.33	14.3
Avg. Value for Road 10, Shahidnagar	1.56	0.98	19.5

Other notable attributes include that the area has lower than the average Connectivity value (3 against the average 5), close to the maximum Entropy R3 value (1.5 against a maximum 1.56) and slightly lower than average Mean Depth R3 value (2.25 against 2.4). Interpretation of these attributes are listed below:

- The Integration [HH] R3 values of the drug crime-prone area of streets are close to “(Average) – (Std. Dev.)” value of the axial map, which means the area is significantly low on pedestrian movement. Field observations indicate that the roads are also narrow and poorly lit after sunsets, while the buildings have minimum visual and physical interaction with the street.
- The Control values of the drug-crime-prone area of streets are close to 1, signifying their strength as a control space. Control is a dynamic local measure of the degree to which a space controls access to its immediate neighbours taking into account the number of alternative connections that each of these neighbours has. People rarely cross Road 10, *Shahidnagar* when they need to go to other places.
- The Choice R3 values of the drug crime prone area of streets are close to 0, the minimum value, highlighting the fact that there is minimum “flow” through them. Choice R3 measures how likely an axial line or a street segment it is to be passed through on all shortest routes from all spaces to all other spaces within a radius of 3 from each segment.
- Entropy in DepthMap is a measure of the distribution

of locations of spaces in terms of their depth from a space rather than the depth itself. If many locations are close to a space, the depth from that space is asymmetric, and the entropy is low. If the depth is more evenly distributed, the entropy is higher. The latter is clearly the case of Road 10, Shahidnagar, which can be interpreted as few locations being close to it, and as a result, an increased crime occurrence.

## 8.0 RESULTS AND DISCUSSION

To summarize, Road 10, Shahidnagar, particularly prone to drug crime among the smaller streets of Lalbagh, was found **to be far from the integration core, to have among the lowest Integration R=10 and Integration R=3 values, near to average Control value, much below average Choice R3 value and a very high Entropy value** as syntactic properties of space. Thus, for the selected streets of Lalbagh, the results showing minimal frequency of people's movement are not in consistence with Crime Pattern Theory; nevertheless, the results can be well interpreted as a lack of "surveillance" being the main cause of crime occurrence – this behavioural feature made easy to be analysed by means of Space Syntax.

This analysis generates encouraging results to prove that syntactic measures of spatial analysis can explain drug crime rates of streets, particularly in the case of Lalbagh area, although crime data of a much longer period could have generated better results. The physical condition of the street can also be attributed as an important factor of crime occurrence in Lalbagh. Further photographic and map data would have been more helpful but could not be taken as a helping hand due to time constraints, whereas crime data from a much longer time period would have been more useful. Nevertheless, these findings could pave the way for further research having the application of Space Syntax methodology in Old Dhaka.

## 9.0 CONCLUSION

This paper has attempted to understand the relation of human behaviour as in the behaviour of criminals at Lalbagh with respect to spatial features of built-up urban areas with the help of Space Syntax. The results mark the absence of surveillance in the street as the main cause of crime occurrence; however, further research involving extensive crime data will

help us accurately predict the spatial features of drug-crime-prone streets at Lalbagh, Old Dhaka.

In the design of environments, the police can be more vigorously involved with architects and planners utilizing Space Syntax methodology to make it less crime-prone in Dhaka City. It is encouraged to take into account the physical condition of the street and the adjacent land use along with spatial analysis, nevertheless, Space Syntax methodology has turned out to be a fairly efficient tool for explaining drug crime in Lalbagh, while it can be expected to generate similar results for the other parts of the city. Besides drug crime, other aspects of human behaviour can be studied and related to space syntax in future research proposals.

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