DOI: 10.52131/pjhss.2024.v12i2.2220

Pakistan Journal of Humanities and Social Sciences

Volume 12, Number 02, 2024, Pages 1563–1581
Journal Homepage:
https://journals.internationalrasd.org/index.php/pjhss

The Impact of Urban Streets Layout on Crimes: A Space Syntax Analysis of Hayatabad Peshawar

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ARTICLE INFO

Article History:

Received:	April 24, 2024
Revised:	May 27, 2024
Accepted:	May 28, 2024
Available Online:	May 29, 2024

Keywords:
Space Syntax
Crime Rates
UCL Depthmap
Streets Layout
Hayatabad

Funding:
This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ABSTRACT

Urban population is on a rising trend and with that, the planning and design of cities and urban settings has a vital role to play in making sure that our cities remain pleasant, healthy, and safe. Crime prevention as a goal is often overlooked in urban planning and has a drastic effect on the quality of urban life. In this study, the street layout of Hayatabad, Peshawar is analyzed through axial map analysis using UCL Depthmap software based on Space Syntax theory to identify possible crime hotspots in the area. The possible hotspots in existing street layout of the area are identified based on the integration values from analysis. Thereafter, a proposed street layout, with addition of new streets, is presented that significantly improves the safety of existing street layout with regard to crime occurrence by improving the global integration of the layout.

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1. Introduction

Pakistan's urban population is expanding rapidly, and the fundamental characteristic of cities is to make our urban living safer and secure. Patricia Brantingham observed that urban planners often employ land use regulations to achieve certain economic and social goals. One notable social goal which is crime reduction has been hardly ever incorporated by planners. The main focus of planners is mostly "think of parks and noise levels, but not of crime" (Piombini, 1987). Recent research is proof of such beliefs which leads to the impression that planners may unknowingly be providing and designing an environment which is a cause in initiating and stimulating urban crime issues and foster fear of crime (FOC) (Gardiner, 1978). The urban environment's impact on quality of life is a significant concern across several disciplines; such as architecture and planning, politics, geography, sociology and economics (Jones & Fanek, 1997). The quality of urban life is deteriorating as a result of a variety of urban issues, such as the rising incidence of crimes in urban areas. Crime is, in fact, the most prevalent urban issue.

2. Literature Review

Over the last two decades, urban policymakers have utilized environmental criminology principles to enhance urban safety. These measures have led to the success of programs like Secured by Design, the Dutch Police Label Safe Housing, and the preventative design of parking areas. Nowadays, it is well acknowledged that changing the physical features of the built environment might restrict criminal possibilities (López, 2005). Environmental criminology presently concentrates on the physical attributes of targets over the spatial arrangement of urban environments, specifically addressing the connection between private and public realms. Although criminological disciplines recognize that both spatial and physical factors influence the occurrence of criminal incidents. However, crime control strategies often overlook the significance of spatial factors. Historically, the field of police practice has been lacking in tools and knowledge to effectively address and quantify spatial characteristics. However, this situation has changed in recent times.

The architectural and planning professions have been provided with a valid scientific and rigorous instrument for evaluating existing and proposed projects as a result of the recent emergence of the Space Syntax theory. The Space Syntax theory has shown potential to improve the character of the environment in a variety of situations, as evident by few theoretical and real-world applications of research. These results are encouraging. It seems that the potential to enhance social interaction can be achieved by implementing circulation patterns that are specifically designed to enhance the livability of urban residential and commercial areas.

2.1. Urbanism and Environmental Criminology

2.1.1. Insights from Environmental Criminology

In general, the majority of the "design for crime prevention" work has been based on three theories that are associated with crime: the rational offender theory (also known as rational choice theory), the behavioral geography theory, and the routine activities theory (Taylor, 2003). Cesare Beccaria established the classical school of criminology, from which the rational offender theory emerged. He was of the opinion that individuals possess the capacity to act autonomously and that crime can be suppressed through the application of punishment. Nevertheless, this viewpoint dissipated by the mid-20th century, as positivist criminology contended that crimes are the consequence of inherited, social, and psychological factors instead of individual choices and decision-making. (Siegel, 2002). The classical school of criminology's ideas were bolstered by the rational choice theory in the 1970s, which posited that the favorable effects of crime influence the patterns of offensive behavior. In other words, offenders are rational actors who evaluate the potential repercussions of their actions and the costs of crime (Siegel, 2002). Their decision-making process takes into account both personal requirements, such as exhilaration and money, and situational factors, such as the probability of being captured and surveillance. Conversely, the behavioral geography theory acknowledges that locations that are situated in close proximity to the residences or workplaces of offenders are at a greater risk of burglary than those that are not on their regular route. It is possible to derive that this theory implies that the crime rate is associated with ease of access. (Taylor, 2003).

The routine activities theory examines the interaction of three commonplace variables: 1. The existence of motivated offenders, such as adolescents and unemployed individuals; 2. The absence of guardians, such as neighbors, householders, or police; and 3. the existence of attractive targets, such as unlocked residences and attractive valuables (Reid, 2017; Siegel, 2002). Targets are at an increased risk for being victimized when they have access to all of the three factors. The situational crime prevention program was founded on the rational offender theory (Bennett, 2014). It is designed to decrease the likelihood of burglaries occurring by assuming that offenders intentionally and freely perpetrate crimes in response to immediate circumstances, influenced by the costs and rewards. Situational measures operate at three levels, as per Bennett (2014)'s review. Initially, situational measures necessitate the installation of surveillance cameras and alarms, as well as the fortifying of targets at the individual level. Offenders perceive the time required to surpass these obstacles as a risk. Subsequently, neighborhood surveillance systems have been implemented at the community level to encourage residents to report any suspicious activities. To date, there has been no evidence to suggest whether this was perceived as a risk by offenders. Thirdly, situational measures are founded on Jacobs and Newman's concepts of territoriality, natural surveillance, and the regulation of pedestrian and vehicular traffic at the physical environment level. Jacobs posited that inhabitants acquire ownership and authority over a specific space by occupying and utilizing it. (Jacobs, 1961).

In a certain way, the aforementioned theories and prevention programs can be used to conclude that offenders share four general concerns: the speed at which they can reach the target, the speed at which they can flee, the potential value of the target, and the likelihood of the offender being apprehended while committing the crime or leaving the scene. (Rengert, 1980; Taylor, 2003). Additionally, prior research has demonstrated that the three fundamental components required for an individual to commit a crime are ability, opportunity, and motive. Therefore, if space syntax techniques could be employed to display which streets present a probability to commit a crime, it would be simpler for law enforcement to determine which streets demand increased patrol activities.

2.1.2. Insights from Space Syntax research

Urban and architectural academics have recently presented information about the correlation between spatial arrangement and crime distribution using the space syntax technique. Given the capability of the approach to compute the spatial characteristics of a built environment (Hiller, 2005), it becomes feasible to establish a correlation between these characteristics and measurable crime statistics. Steadman (1983) was the one who presented the space syntax theory for the first time. A year later, a book was published by the authors Hillier and Hanson (1984); with the name "Social Logic of Space" forming the basis of space syntax theory. Space syntax is a theory which is used in understanding the socio-spatial pattern and development of space in architectural and urban context by employing analytical, quantitative and descriptive techniques to figure out the social logic of space (Conroy-Dalton & Bafna, 2003; Dursun, 2007; B. Hillier, 1996; B. Hillier & Hanson, 1984; B. Hillier, Hanson, & Graham, 1987; Jeong & Ban, 2011; Önder & Gigi, 2010; Wineman, Peponis, & Dalton, 2006). Hillier demonstrated that crimes are most likely to occur in areas with limited connectivity and are quieter. Consequently, streets with a higher volume of pedestrian traffic tend to have a lower crime rate (W. Hillier & Shu, 1999).

Space Syntax theory investigates the social features of samples through four basic variables. These are Connectivity, Control value, Choice and Integration (Klarqvist, 2015). Connectivity counts the number of neighbors who are directly connected to the spaces. The control value is a variable measure that is specific to a certain location. The indicator quantifies the extent to which a location controls access to the immediate surroundings, considering the degree of alternative connections available to each neighboring area. Choice is a parameter that quantifies the likelihood of an axial line or street segment being passed by all shortest routes between all locations in the whole system or within a specified distance (radius) from any given segment. Integration represents the mean depth of the given convex space to the all other convex spaces in the system. This calculation is performed individually for each axial line in the system. It actually measures the asymmetry. The formula for measuring relative asymmetry is $=2(MD-1)/(n-2)$ where

MD = Mean depth and can be calculates as global depth divided by (n-1)
n = number of axial lines in the urban system.

Depth is an additional factor that may enhance the analysis in several ways. The term refers to the minimum number of syntactic steps in a graph that are necessary to transition from one point to another (Klarqvist, 2015). The three main definitions for spaces are Convex, Axial and Isovist space (Penn, 2003) which constitutes three applicable analysis systems by the same names: Axial (Turner & Penn, 1999), Convex (Klarqvist, 2015) and Isovist (Turner & Penn, 1999). Space syntax clarifies how spatial configuration impacts the socio-cultural existence (Dursun, 2007).

The concept of designing a neighborhood in which the layout is responsible for the opportunities and the means to carry out crime, Shu and Huang (2003) considered the impact of the three characteristics i.e. constituedness, global and local integration and observed that constituedness and global integration play a positive and sturdy impact in minimizing the burglary rate. Well-connected streets to the broader system are critical in protecting homes against burglary. Jones and Fanek (1997) studied the impact of spatial configuration on crime in Austin, Texas, in a manner similar to that of Shu and Huang's (2003) prior research. For the study, they selected four areas in which each pair had same urban characteristic such as their source of income, poverty rates, population and racial structure of inhabitants. The findings indicated a negative correlation between greater integration values in pairs and crime rates. The authors clarified that an increased number of interconnected streets would draw in a greater volume of pedestrian traffic, resulting in a higher level of surveillance in public spaces. As favorable and encouraging results were produced using space syntax in order to find the spatial distribution of crime, Western Australian city of Gosnells sought advice from the Space Syntax laboratory at University College London and Murdoch University to determine the geographic distribution of crime (Newspaper, 2003). Traffic patterns and space syntax measurements were compared by the Space Syntax Lab with crime data. Strong correlation was found between spatial arrangement and larceny and burglary, which was in line with previous research.

The main hypothesis of this study is that improvement in street layout in Hayatabad Peshawar, will directly impact the global integration and mobility of its street layout resulting in lower probability of crime occurrence in the area.

3. Methodology

In order to perform a comprehensive analysis utilizing the Space Syntax technique to determine the predictability of crime occurrence in urban environments, it was necessary to carefully control and neutralize the factors that are often associated with crime. This include choosing areas that have roughly identical qualities.

The investigation was conducted in all seven phases of Hayatabad Peshawar, as these are all planned and developed sectors. The analysis is conducted through UCL Depthmap. The Depthmap is a software application created by Alasdair Turner at University College London (UCL) that utilizes space syntax theory for syntactic analysis.

3.1. The axial map analysis

The spatial arrangement was examined using space syntax technique, which included giving syntactic values to each street segment inside the system (e.g. all the street segments in Hayatabad). The two syntactic measures used were Connectivity and Integration. The calculations were performed using UCL Depthmap software. Initially, the map of each sector in Hayatabad was transformed using AutoCAD to convex map. The axial lines were manually drawn on the map using AutoCAD in order to generate the axial map. The axial map consists of a network of intersecting axial lines. The axial map is a graphical representation of the most extensive lines of sight that are used to define each street segment inside the Hayatabad region. For instance, if two individuals were positioned at opposite ends of the line, they would have a clear line of sight to one another. The area of Hayatabad consisted of an average of 1107 lines.

Secondly, the UCL Depthmap software was used to calculate all the lines in the system regarding the Integration and Connectivity values. In order to simplify the aforementioned two measures can be explained as, the value of connectivity is achieved by calculating the number of lines directly joined to a specific line. Whereas integration shows how simple a line is to reach. In mathematical terms, it is the mean number of spaces one must pass to reach a particular line from all axial lines in the system. To put it another way, these values propose the extent to which a selected area in the system is more connected (it can be accessible from other spaces with little or no effort) or more isolated (in order to reach a certain space, one has to travel through various spaces). The Space Syntax theory was used to analyze and acquire primary quantitative data for each sector using the UCL Depthmap software. This analysis aimed to identify possible criminal hot spot zones within the chosen areas. The Depthmap analysis obtained the following values: Global Integration, Connectivity, and Intelligibility. An investigation was conducted to examine the relationship between each of these criteria and the occurrence of crime in the selected sectors, in order to determine their predictability.

3.2. Limitation

Numerous factors, such as social, economic and spatial factors are liable for crimes to occur. However, this research is limited in prediction of crime with reference to spatial configuration. The crimes, violent in nature, that the study includes are homicide, sexual offence, robbery and assault. Also, vandalism, vehicular and residential burglary, theft of vehicle and theft (non-vehicle) was incorporated in the research. Organized crimes and crimes involving acquaintances or those crimes such as assault and murder done on the basis of revenge have been omitted from the study.

4. Results and Analysis

The study significantly depended on two kinds of variables: neighborhood street layout as shown in Figure 1, and the corresponding values obtained from Space Syntax analysis as the independent variable, and rates of different forms z crime as the dependent variable.

Figure 1: Hayatabad's Street Layout Plan (Din, Ullah, Qureshi, Saqib, & Ahmad, 2023)

Figure 2: Hayatabad's axial map, showing the longest and fewest straight lines spanning all usable convex regions (Din et al., 2023)

4.1. Syntactic Analysis of Individual Sectors

To acquire the syntactic values, each sector was individually analyzed. Summary of all the sectors is presented below.

4.1.1. Phase 1

Global Integration: The road with the highest level of integration in the context of Global Integration is Lalazar Avenue, with an integration value of 2.40065. The streets with the lowest level of integration, with values below 1, are streets 4 and 73 in D1. 1A, 10A, 12, 13, and 14 in E1 and street 19 in E3 as shown in Figure 3.

Figure 3: Phase 1, Hayatabad, Global Integration Map

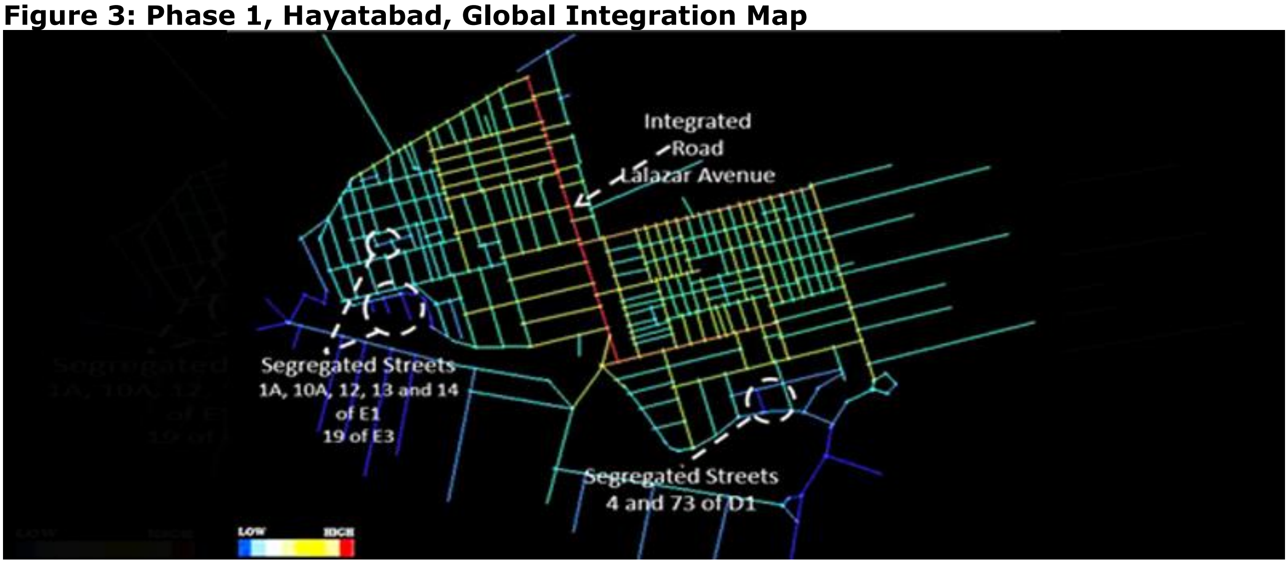
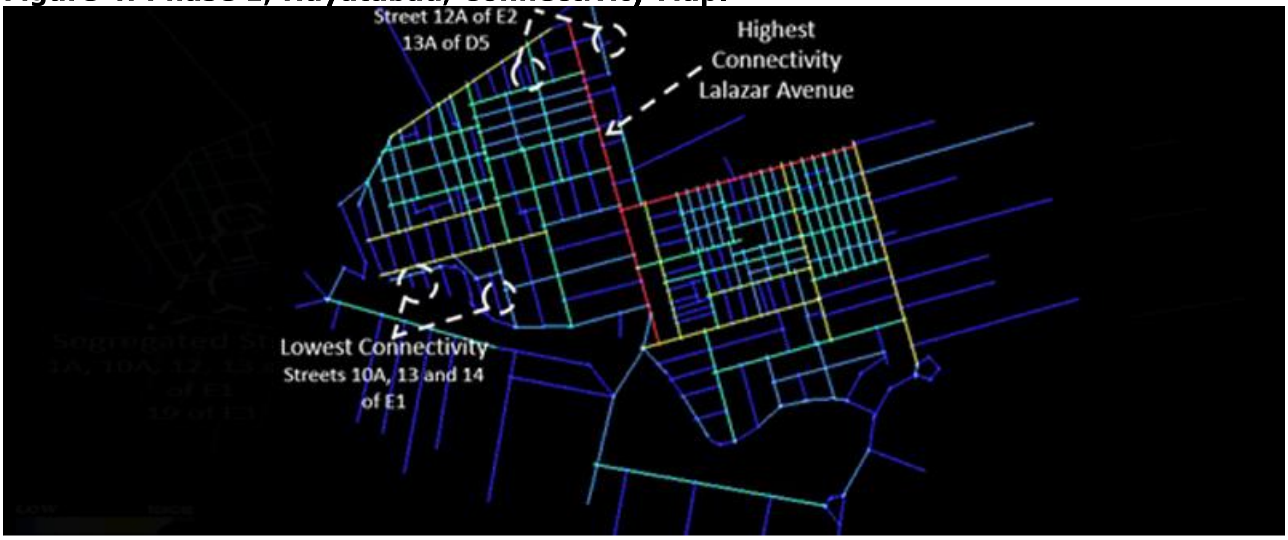


Figure 4: Phase 1, Hayatabad, Connectivity Map.



Connectivity: Lalazar Avenue has the highest connectivity score of 23, while street 10A, 13, and 14 of E1, street 12A of E2, and street 13A of D5 have the lowest connectivity value of 1 as shown in Figure 4.

Intelligibility: Diverse scatter can be seen having a value of r^2 0.253701 by using Scattergram as shown in Figure 5. Syntactic analysis summary of Phase 1 is presented in Table 1.

Figure 5: Phase 1, Hayatabad, Scattergram.

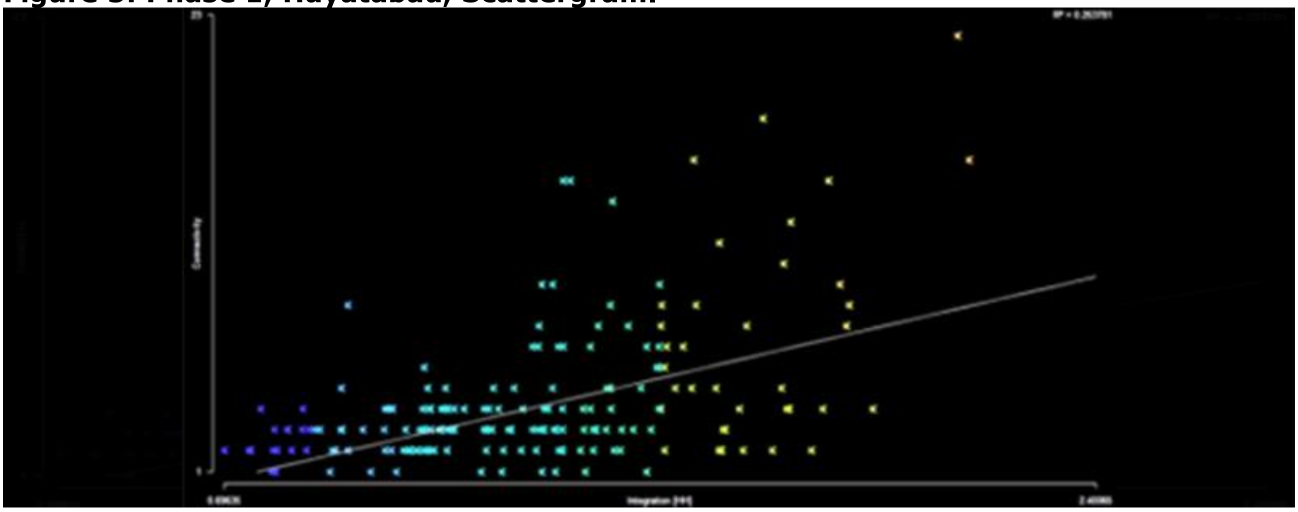


Table 1: Phase 1, Hayatabad, Analysis Summary

Phase 1		Mean	Minimum	Maximum
	Integration	1.30856	0.69635	2.40065
Lines	Connectivity	4.13734	1	23
Count:233	Mean Depth	5.3133	3.21552	8.63793

4.1.2. Phase 2

Global Integration: The street with the highest level of integration in the case of Global Integration is street No. 3, with an integration value of 2.59342. The streets with the lowest level of integration, indicated by values below 1, are 15, 14, 12, 12A, 10A, and 11C in the G3 area and 1C as shown in Figure 6.

Figure 6: Phase 2, Hayatabad, Global Integration Map.

Connectivity: Hayatabad Peshawar Road has the highest connectivity score of 26, while street 5 of H-4, 21A and 21B have the lowest connectivity value of 1 as shown in Figure 7.

Figure 7: Phase 2, Hayatabad, Connectivity Map.

Intelligibility: Diverse scatter can be seen having a value of r^2 0.313835 by using Scattergram as shown in Figure 8. Syntactic analysis summary of Phase 2 is presented in Table 2.

Figure 8: Phase 2, Hayatabad, Scattergram.

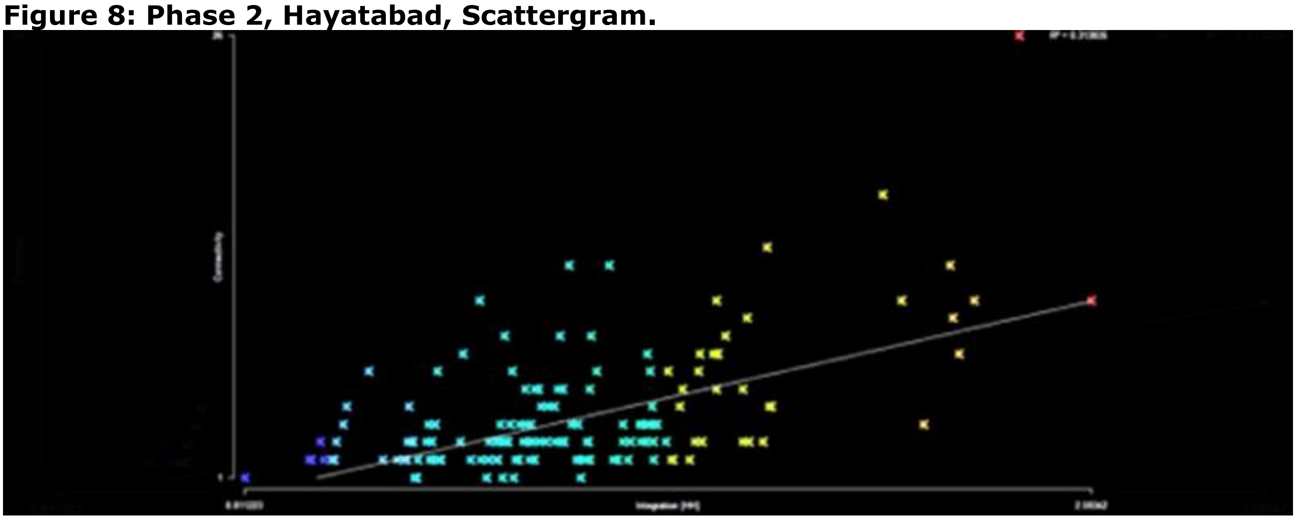


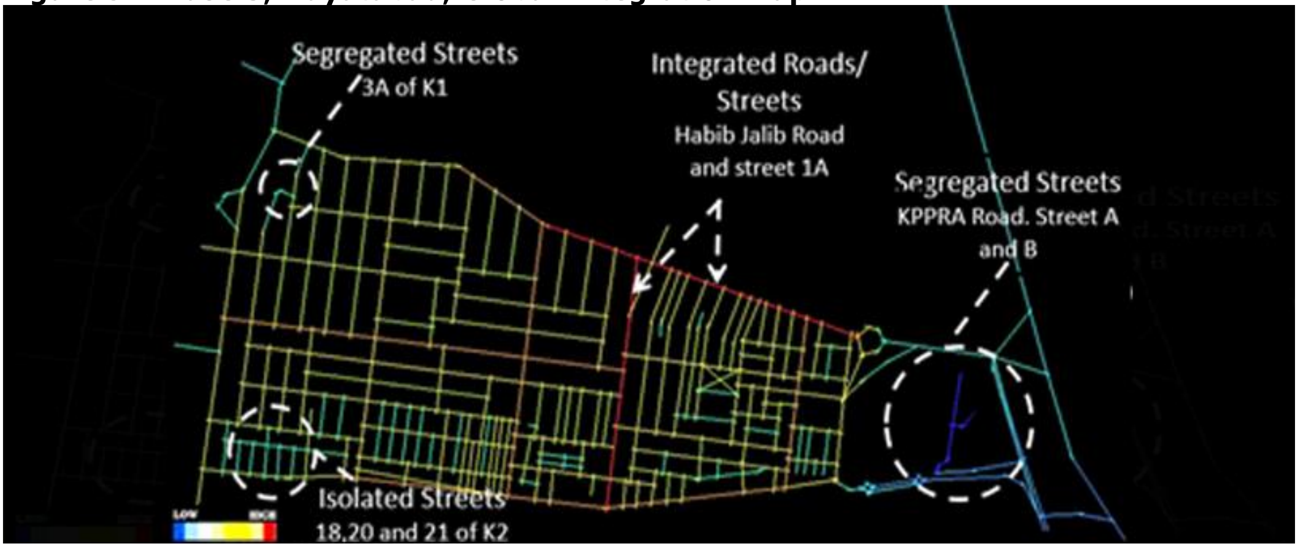
Table 2: Phase 2, Hayatabad, Analysis Summary

Phase 2		Mean	Minimum	Maximum
	Integration	1.50179	0.811233	2.59342
Lines	**Connectivity**	4.28902	1	26
Count:173	**Mean Depth**	4.39965	2.88953	7.0407

4.1.3. Phase 3

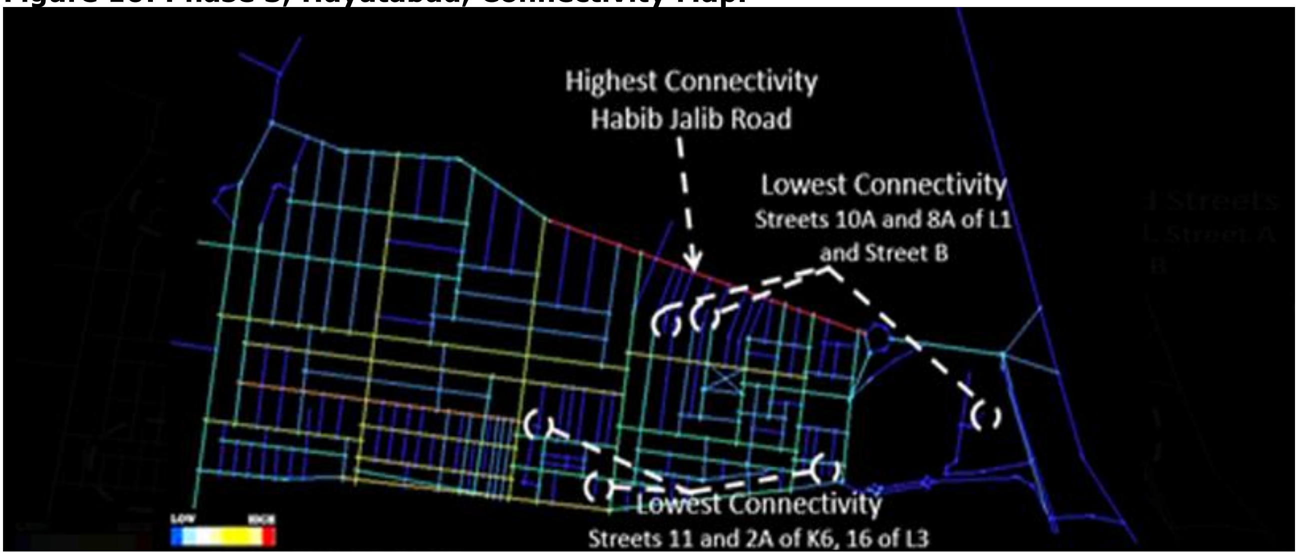
Global Integration: The road with the highest level of integration in the context of Global Integration is Habib Jalib Road, with an integration value of 1.93397. Following closely is street 1A, with an integration value of 1.94749. The streets with the lowest level of integration, indicated by values below 1 are 3A in the K1 area, 18, 20, and 21 in the K2 area, 7B in the K6 area, and KPPRA Road, Street A and Street B as shown in Figure 9.

Figure 9: Phase 3, Hayatabad, Global Integration Map



Connectivity: Habib Jalib Road has the highest connectivity score of 22, while street 11 and 2A of K6, 10B and 8B of L1, 16 of L3 and B have the lowest connectivity value of 1 as shown in Figure 10.

Figure 10: Phase 3, Hayatabad, Connectivity Map.



Intelligibility: Diverse scatter can be seen having a value of r^2 0.253209 by using Scattergram as shown in Figure 11. Syntactic analysis summary of Phase 3 is presented in Table 3.

Figure 11: Phase 3, Hayatabad, Scattergram.

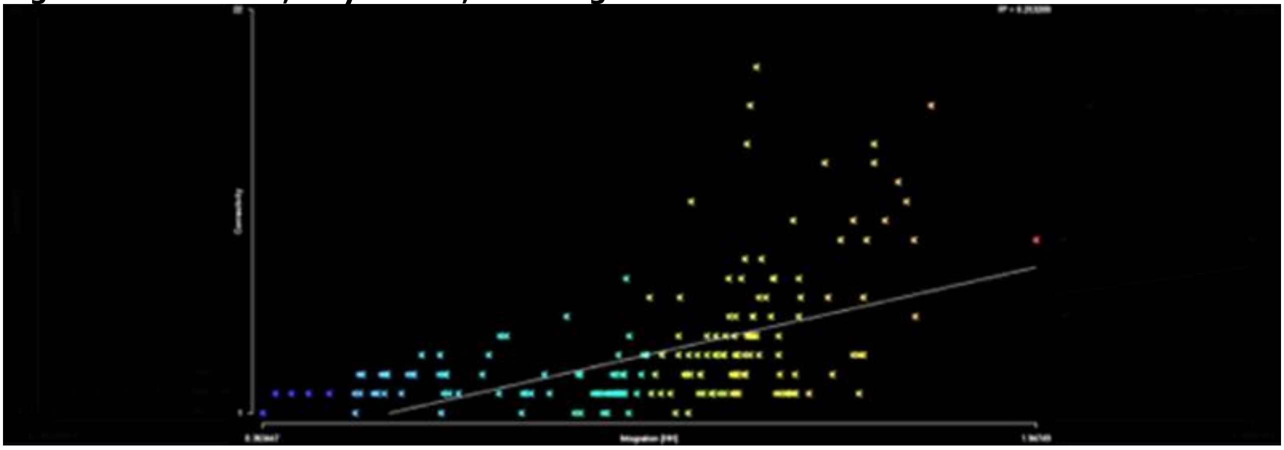


Table 3: Phase 3, Hayatabad, Analysis Summary

Phase 3		Mean	Minimum	Maximum
	Integration	1.17745	0.363447	1.94749
Lines	Connectivity	4.17674	1	22
Count:215	Mean Depth	5.85599	3.6729	15.3224

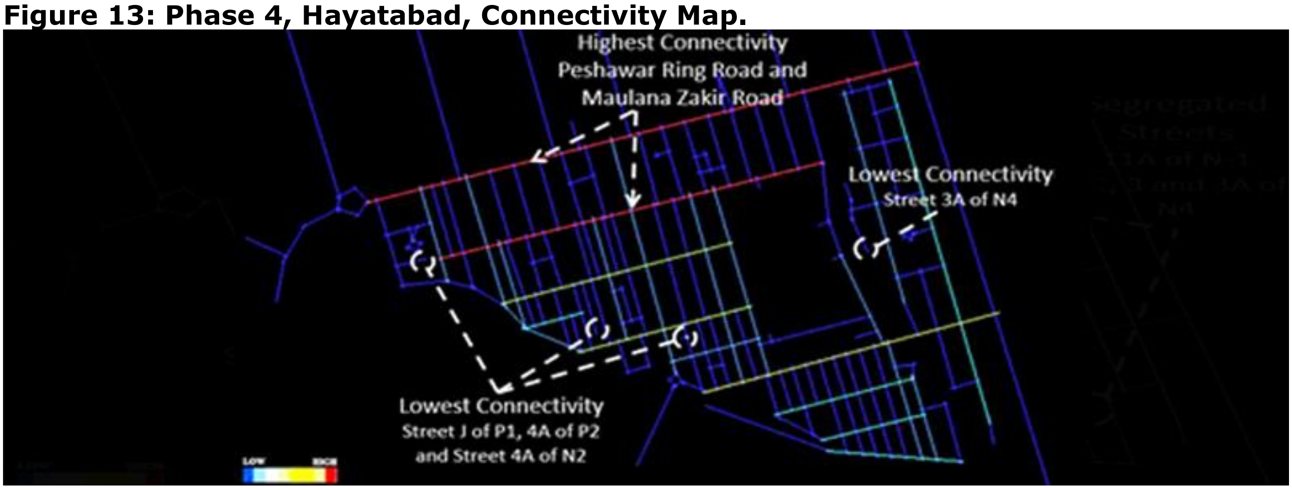
4.1.4. Phase 4

Global Integration: The Ring Road is the most integrated road in the case of Global Integration, with an integration value of 2.51436. The streets with the lowest level of integration with values below 1, are street I in P1, 11A in N-1, and 3C and 3A in N4 as shown in Figure 12.

Figure 12: Phase 4, Hayatabad, Global Integration Map.

Connectivity: The connectivity value of Peshawar Ring Road and Maulana Zakir Road is the highest at 32, whereas street J of P1, street 4A of P2, 4A of N2 and 3A of N4 have the lowest connectivity value of 1 as shown in Figure 13.

Figure 13: Phase 4, Hayatabad, Connectivity Map.



Intelligibility: Diverse scatter can be seen having a value of r^2 0.2234 by using Scattergram as shown in Figure 14. Syntactic analysis summary of Phase 4 is presented in Table 4.

Figure 14: Phase 4, Hayatabad, Scattergram

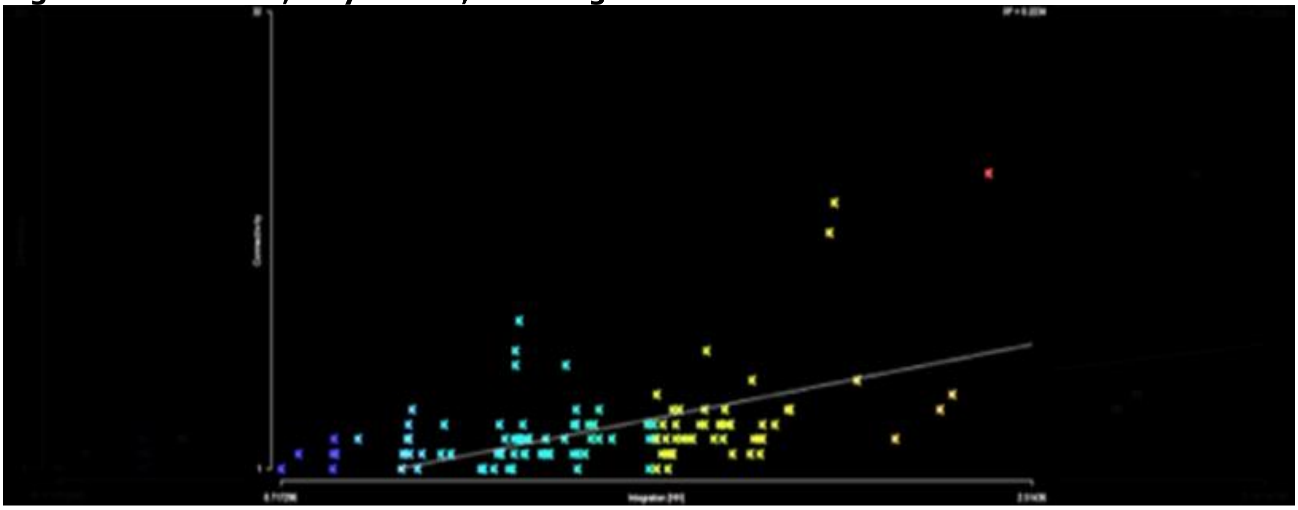


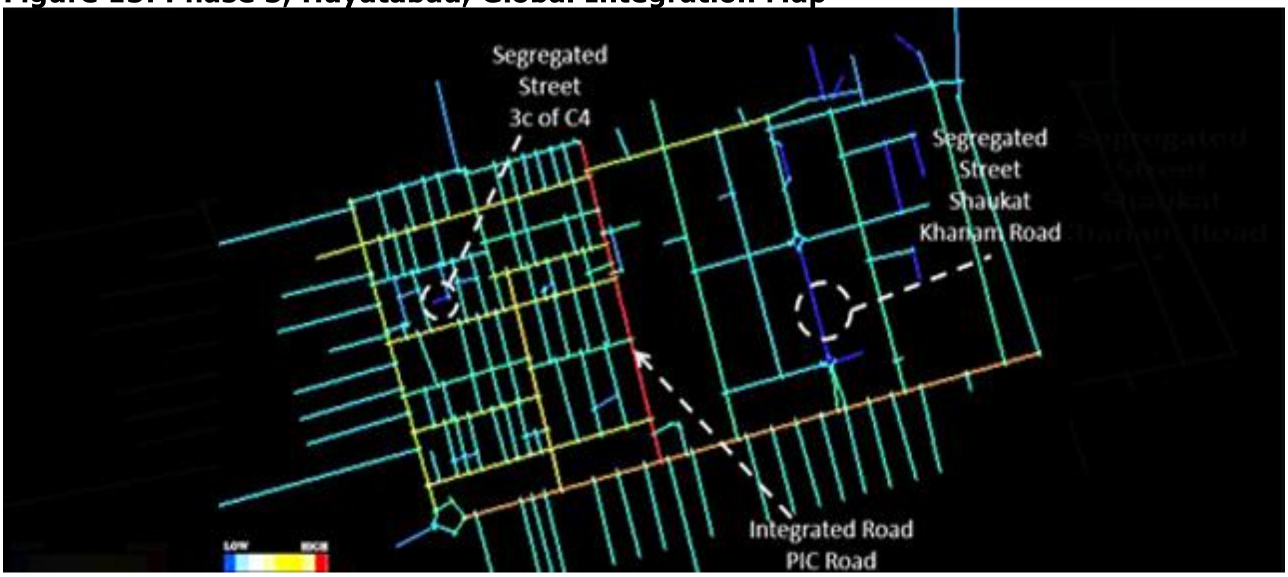
Table 4: Phase 4, Hayatabad, Analysis Summary.

Phase 4		Mean	Minimum	Maximum
	Integration	1.49569	0.717296	2.51436
Lines Count:	Connectivity	3.76159	1	32
151	Mean Depth	4.37563	2.87333	7.56667

4.1.5. Phase 5

Global Integration: The road with the highest level of integration in the case of Global Integration is PIC Road, with an integration value of 3.19213. Shaukat Khanam Road and street 3C of C4 are the streets with the lowest level of integration, both with values below 1 as shown in Figure 15.

Figure 15: Phase 5, Hayatabad, Global Integration Map



Connectivity: Peshawar Ring Road has the highest connectivity score of 29 among all the streets, whereas street 1A and street B of A1, street 5A of C2, and street 3C of C4 have the lowest connectivity score of 1 as shown in Figure 16.

Figure 16: Phase 5, Hayatabad, Connectivity Map

Intelligibility: Relatively less diverse scatter can be seen having a value of r^2 0.367268 by using Scattergram as shown in Figure 17. Syntactic analysis summary of Phase 5 is presented in Table 5.

Figure 17: Phase 5, Hayatabad, Scattergram.

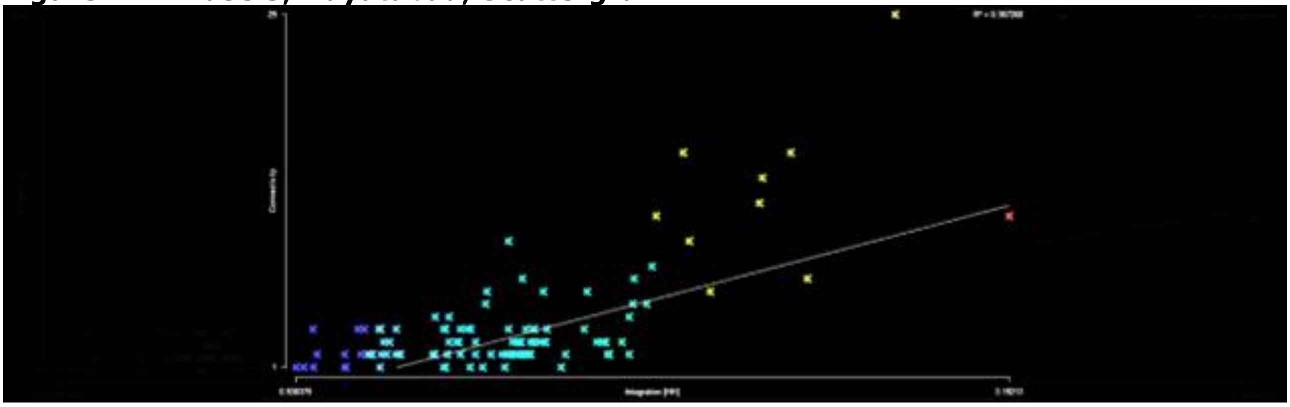


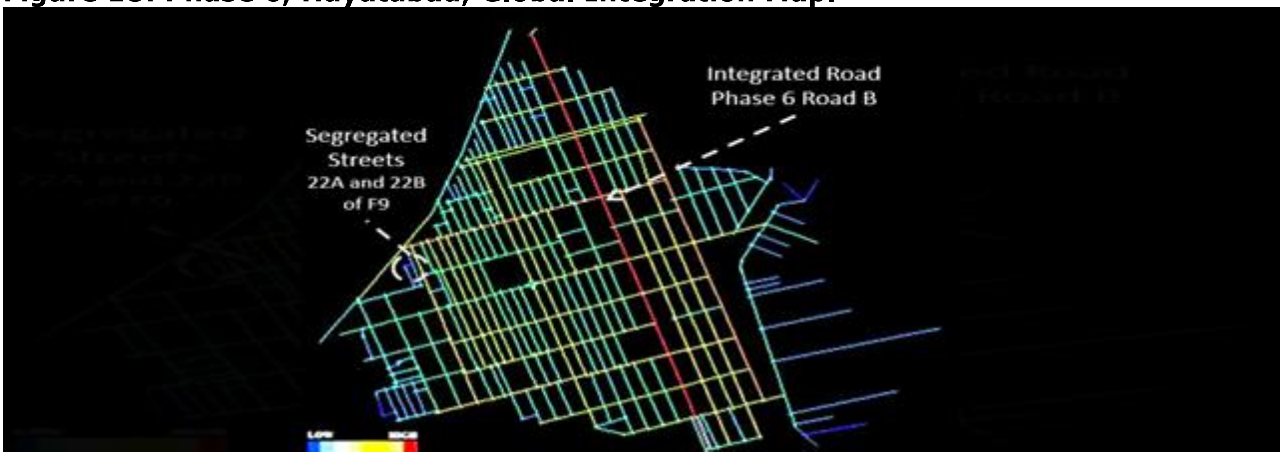
Table 5: Phase 5, Hayatabad, Analysis Summary.

Phase 5		Mean	Minimum	Maximum
	Integration	1.62466	0.938389	3.19213
Lines	Connectivity	3.41935	1	29
Count:155	Mean Depth	4.04876	2.48701	6.05844

4.1.6. Phase 6

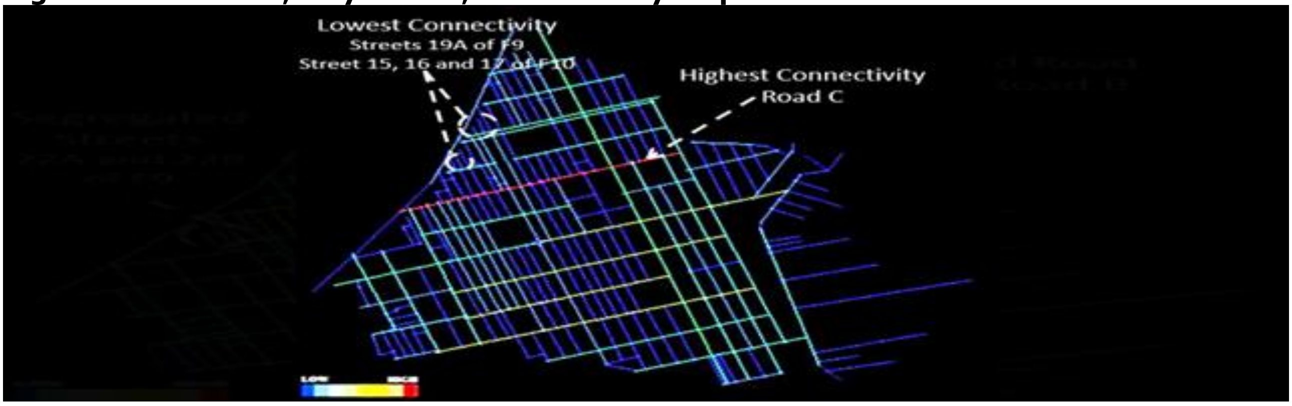
Global Integration: The road with the highest level of integration in the context of Global Integration is Phase 6 Road B, with an integration value of 3.46184. The streets with the lowest level of integration, with values below 1.02, are 22A and 22B of F9 as shown in Figure 18.

Figure 18: Phase 6, Hayatabad, Global Integration Map.



Connectivity: Road C has the highest connectivity score of 38, while street 19A in F9 and streets 15, 16, and 17 in F10 have the lowest connectivity value of 1 as shown in Figure 19.

Figure 19: Phase 6, Hayatabad, Connectivity Map.



Intelligibility: Relatively less diverse scatter can be seen having a value of r^2 0.433044 by using Scattergram as shown in Figure 20. Syntactic analysis summary of Phase 6 is presented in Table 6.

Figure 20: Phase 6, Hayatabad, Scattergram

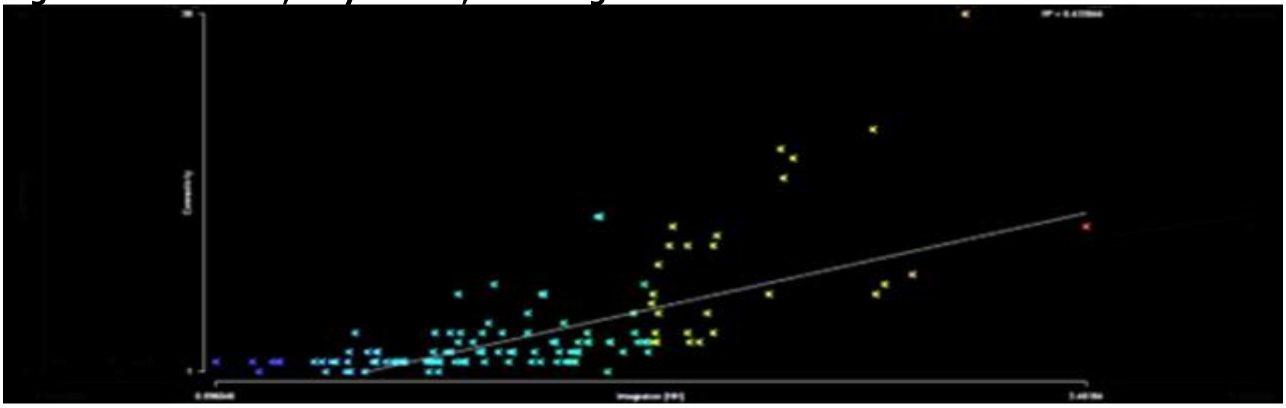


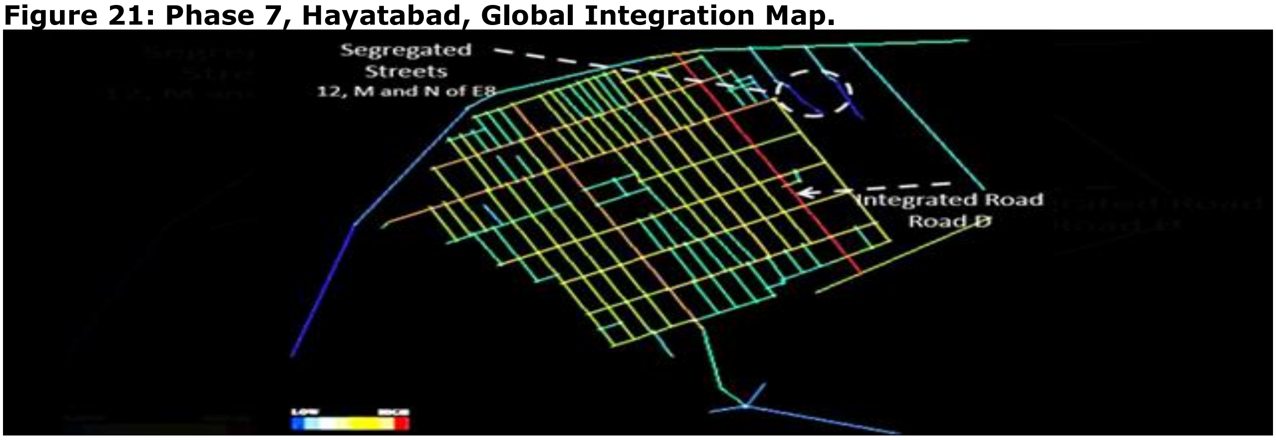
Table 6: Phase 6, Hayatabad, Analysis Summary

Phase 6		Mean	Minimum	Maximum
	Integration	1.78777	0.896046	3.46184
Lines	Connectivity	4.43617	1	38
Count:188	Mean Depth	3.96638	2.4492	6.59893

4.1.7. Phase 7

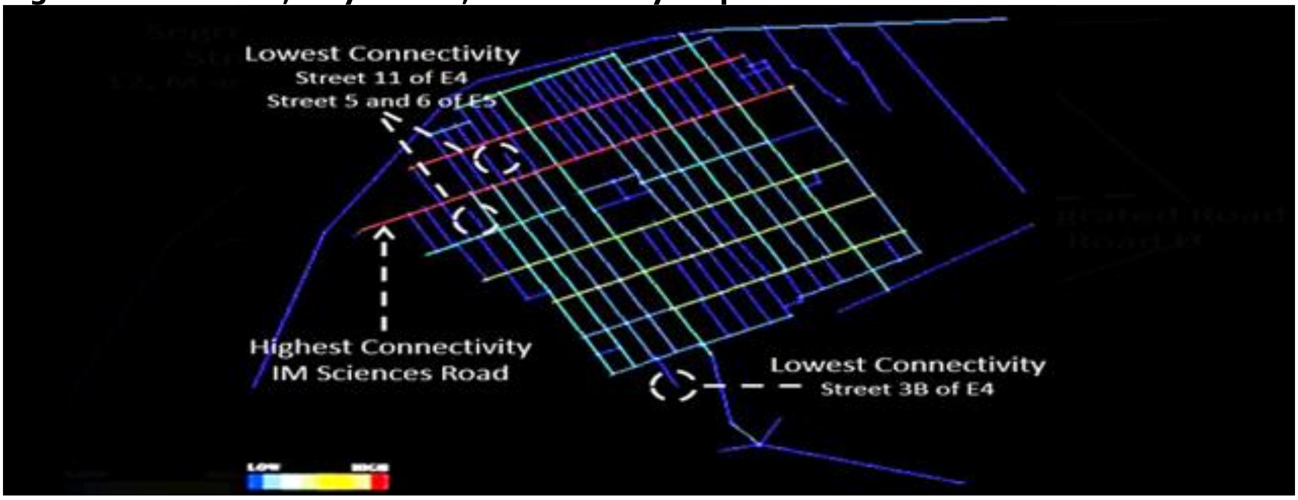
Global Integration: Road D has the highest level of integration, with a score of 2.75878, in the case of Global Integration. The streets with the lowest level of integration, with values below 1, are 12, M, and N of E8 as shown in Figure 21.

Figure 21: Phase 7, Hayatabad, Global Integration Map.



Connectivity: The IM Sciences road has the highest connectivity score of 30, while street 3B and 11 in E4, and street 5 and 6 in E5 have the lowest connectivity value of 1 as shown in Figure 22.

Figure 22: Phase 7, Hayatabad, Connectivity Map



Intelligibility: Relatively less diverse scatter can be seen having a value of r^2 0.354716 by using Scattergram as shown in Figure 23. Syntactic analysis summary of Phase 7 is presented in Table 7.

Figure 23: Phase 7, Hayatabad, Scattergram.

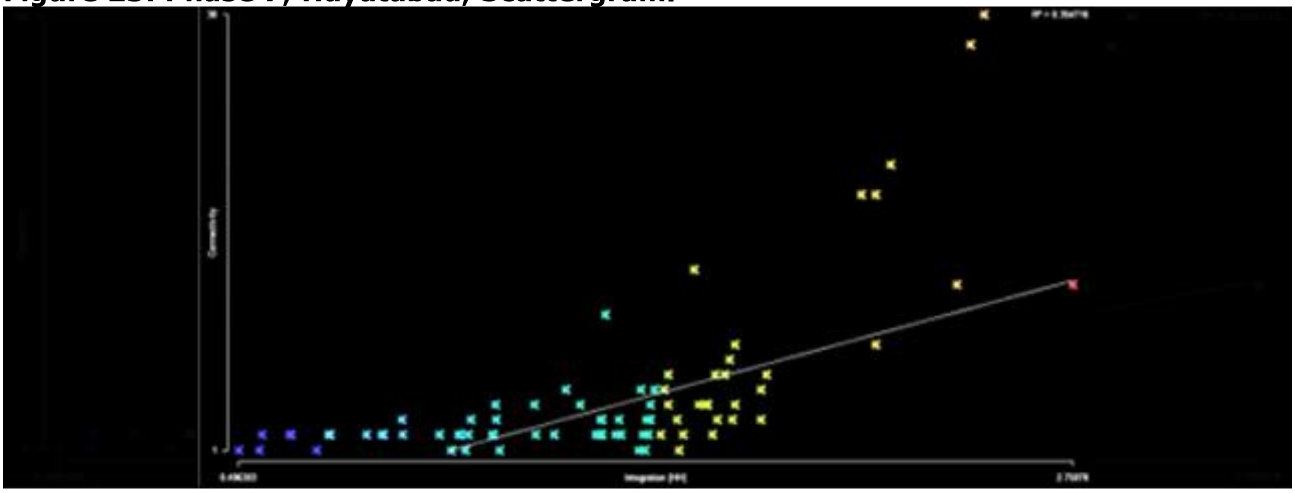


Table 7: Phase 7, Hayatabad, Analysis Summary.

Phase 7		Mean	Minimum	Maximum
	Integration	1.52766	0.496303	2.75878
Lines	Connectivity	4.05217	1	30
Count:115	Mean Depth	4.14874	2.57018	9.72807

5. Conclusion of Syntactic Analysis

Increased integration values are correlated with increased levels of mobility at the corresponding scales, namely for pedestrians and vehicles, as indicated by prior research conducted by UAS and Jones and Fanek (1997). Increased mobility is likely to lead to decreased crime rates. The underlying concept is that an increase in movement will lead to an increase in co-presence and co-awareness. Consequently, the presence of a greater number of individuals and their eyes in public spaces may present challenges for individuals who are attempting to engage in criminal activities. It is anticipated that enhanced surveillance will decrease the likelihood of potential offenders committing their crimes, which may lead to detection and incarceration.

The intelligibility of each sector was illustrated by the scattergram, and areas with low global integration were identified through space syntax analysis. Scattergram shows the highest intelligibility score r^2 0.433044 of Phase 6 followed by Phase 5 with intelligibility value of r^2

0.367268. These 2 sectors have only 2 streets of each sector having low global integration and thus have the low probability of crime occurrence with reference to spatial configuration. Phase 4 has the lowest intelligibility score r^2 0.2234 having 5 streets with low global integration and dispersed among 3 different locations of the sector. Intelligibility shows the comparative probability among the sectors while global integration indicates the locations with low pedestrian and vehicular moments. These two factors are significantly correlated with the occurrence of crimes. Figure 24 encircles the crime hot locations areas that were identified through UCL Depthmap.

Figure 24: Hayatabad, Axial Map, depicting crime hot locations.

5.1. Recommendations

The locations with low global integrations identified by UCL Depthmap as shown in Figure 24 were investigated and additional streets were proposed connecting the existing streets with the streets having low global integration. The research investigated and discovered that by modifying the current street layout as proposed in Figure 25, the integration values, as measured by space syntax, may be significantly enhanced and the movement both at pedestrian and vehicular level will be enhanced. Due to increase in level of mobility the lower crime rate is expected as research conducted by Jones & Fanek (1997) and Hiller & Shu (1999). This, as indicated, will have a substantial favorable impact on the likelihood of crime occurring in the hotspots.

5.2. Proposed Layout Plan of Hayatabad Peshawar

Figure 25: Hayatabad, Proposed Layout Plans of the Streets.

5.2. Proposed Street Layout and Integration Results

5.2.1. Phase 1

Figure 26: Phase 1, Hayatabad, Global Integration Map.

Additional streets proposed connecting least integrated streets as predicted by UCL Depthmap are street 73 to street 3 and street 74 to street 4 of D1, street 10A to street 3, street 1A, 12 and 13 to street 9 of E1 and street 19 to street 14 of E3. Integration values of the adjoining streets, that had low integration value, with addition of proposed streets are enhanced from below 1 to above 1 while overall mean integration value of Phase 1 is enhanced from 1.30856 to 1.33172. Summary of the syntactic analysis is presented in Table 8.

Table 8: Phase 1, Hayatabad, Analysis Summary.

Phase 1		Mean	Minimum	Maximum
	Integration	1.33172	0.754621	2.44107
Lines	Connectivity	4.25532	1	23
Count:235	Mean Depth	5.22706	3.18376	8.0641

5.2.2. Phase 2

Figure 27: Phase 2, Hayatabad, Global Integration Map.

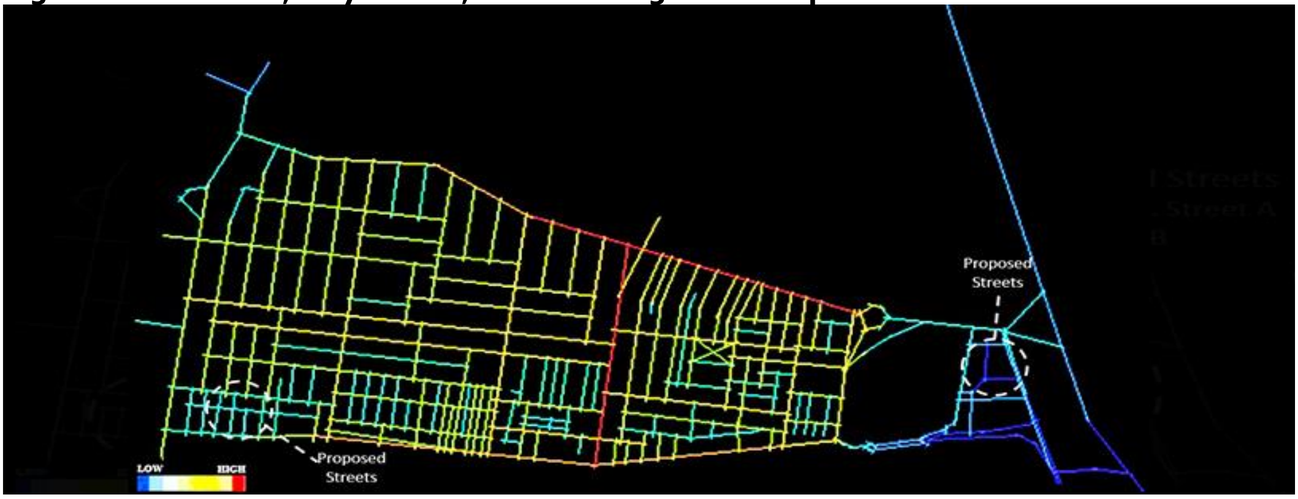
Additional streets proposed connecting least integrated streets as predicted by UCL Depthmap are streets 12, 13, 14 and 15 to street 12A and phase 2 road, while street 10A to street 14 of G3. Integration values of the adjoining streets, that had low integration values, with addition of proposed streets are enhanced from below 1 to above 1 while overall mean integration value of Phase 2 is slightly decreased from 1.50179 to 1.4961. Summary of the syntactic analysis is presented in Table 9.

Table 9: Phase 2, Hayatabad, Analysis Summary.

Phase 2		Mean	Minimum	Maximum
	Integration	1.4961	0.825736	2.57669
Lines	Connectivity	4.38857	1	26
Count:175	Mean Depth	4.41642	2.90805	6.95402

5.2.3. Phase 3

Figure 28: Phase 3, Hayatabad, Global Integration Map.



Additional streets proposed connecting least integrated streets as predicted by UCL Depthmap are streets 18, 20 and 21 to street 13 of K2, while street A and B to KPPRA and Habib Jalib Road. Integration values of the adjoining streets, that had low integration values, with addition of proposed streets are enhanced from below 1 to above 1 while overall mean integration value of Phase 3 is slightly enhanced from 1.17745 to 1.18771. Summary of the syntactic analysis is presented in Table 10.

Table 10: Phase 3, Hayatabad, Analysis Summary.

Phase 3		Mean	Minimum	Maximum
	Integration	1.18771	0.576309	1.97801
Lines	Connectivity	4.29596	1	22
Count:223	Mean Depth	5.75033	3.65766	10.1216

5.2.4. Phase 4

Figure 29: Phase 4, Hayatabad, Global Integration Map.

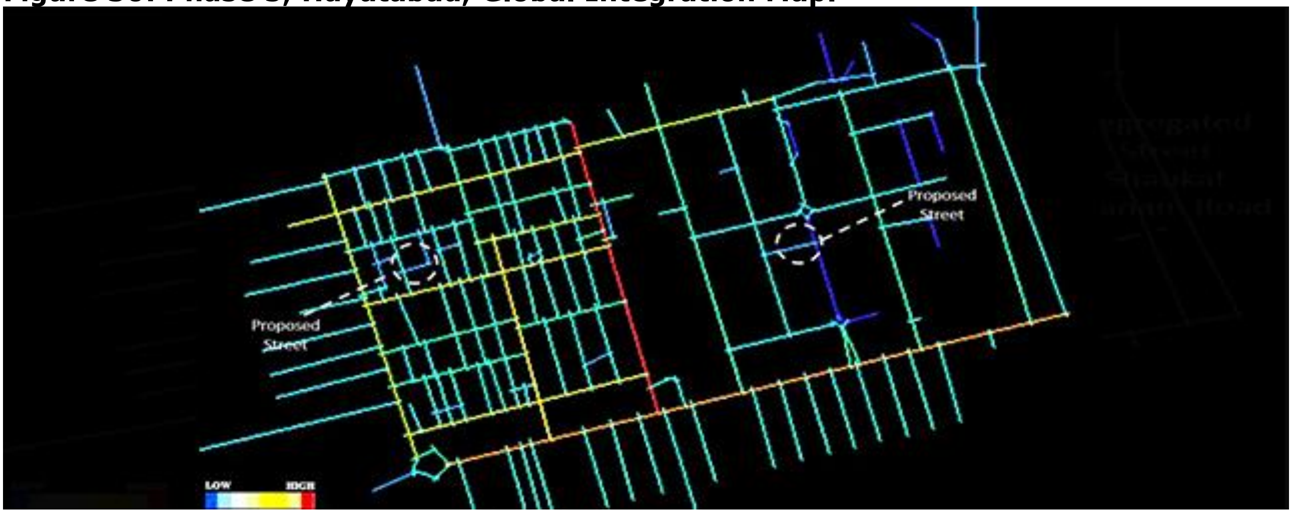
Additional streets proposed connecting least integrated streets as predicted by UCL Depthmap are streets 11A to street 3 of N1, street 3A and 3C to street 5 and HMC Road. Integration values of the adjoining streets, that had low integration values, with addition of proposed streets are enhanced from below 1 to above 1 while overall mean integration value of Phase 4 is enhanced from 1.49569 to 1.51509. Summary of the syntactic analysis is presented in Table 11.

Table 11: Phase 4, Hayatabad, Analysis Summary.

Phase 4		Mean	Minimum	Maximum
	Integration	1.51509	0.723044	2.54703
Lines	Connectivity	3.80645	1	32
Count:155	Mean Depth	4.33372	2.86364	7.56494

5.2.5. Phase 5

Figure 30: Phase 5, Hayatabad, Global Integration Map.



Additional streets proposed connecting least integrated streets as predicted by UCL Depthmap are streets 3C to street 3 of C4 and Shaukat Khanam Road to NADRA Road. Integration values of the adjoining streets, that had low integration values, with addition of proposed streets are enhanced from below 1 to above 1 while overall mean integration value of Phase 5 is enhanced from 1.62466 to 1.63132. Summary of the syntactic analysis is presented in Table 12.

Table 12: Phase 5, Hayatabad, Analysis Summary.

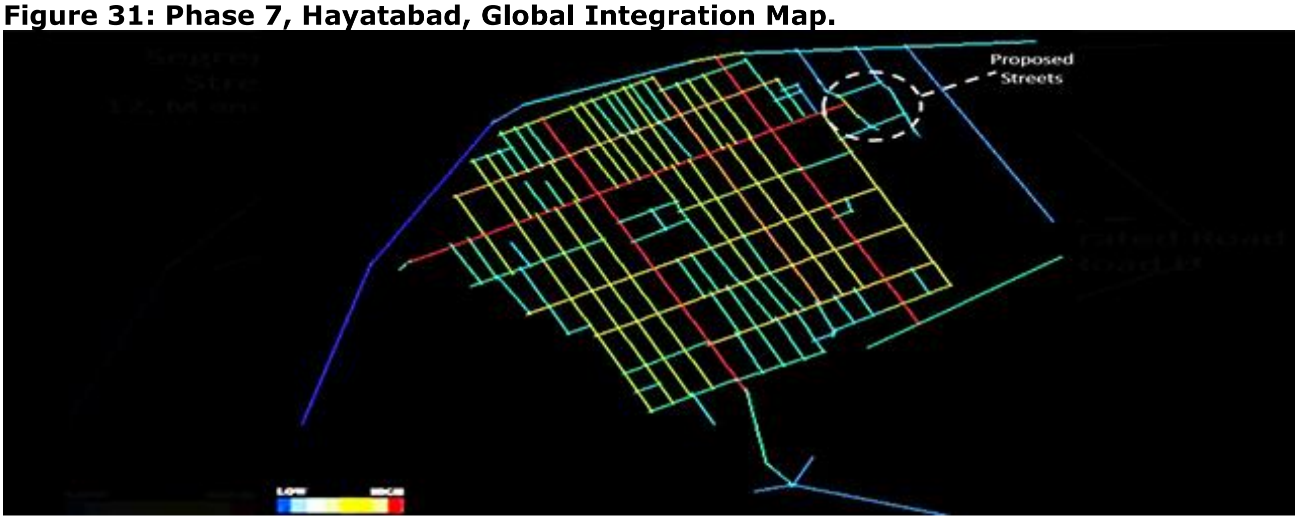
Phase 5		Mean	Minimum	Maximum
	Integration	1.63132	0.942629	3.23305
Lines	Connectivity	3.4359	1	29
Count:156	Mean Depth	4.03606	2.47097	6.04516

5.2.6. Phase 6

Street layout for Phase 6 is not proposed as the streets of F9 with low Global Integration values are under the control of Frontier Constabulary and it is public restricted area.

5.2.7. Phase 7

Figure 31: Phase 7, Hayatabad, Global Integration Map.



Additional streets proposed connecting least integrated streets as predicted by UCL Depthmap are streets M and N to street 12 of E8. Integration values of the adjoining streets, that had low integration values, with addition of proposed streets are enhanced from below 1 to above 1 while overall mean integration value of Phase 7 is significantly enhanced from 1.52766 to 1.73668. Summary of the syntactic analysis is presented in Table 13.

Table 13: Phase 7, Hayatabad, Analysis Summary.

Phase 7		**Mean**	**Minimum**	**Maximum**
	Integration	1.73668	0.715656	3.11885
Lines	Connectivity	4.11966	1	31
Count:117	Mean Depth	3.69791	2.39655	7.08621

5.3. Future work

This research is limited to the crime occurrence with reference to spatial configuration and Space Syntax theory was used for detection of crime hot spots, as discussed in limitation section. This research can be enhanced by comparing the Space Syntax values with crime data of the Hayatabad. As this study has only considered the spatial factors responsible for crime occurrence, it can be broadened to other factors such as social and economic factors responsible for crime occurrence to devise a holistic findings and solutions for crime prevention.

References

Bennett, T. (2014). Burglars' choice of targets. In *The Geography of Crime (RLE Social & Cultural Geography)* (pp. 176-192): Routledge.

Conroy-Dalton, R., & Bafna, S. (2003). *The syntactical image of the city: A reciprocal definition of spatial elements and spatial syntaxes.* Paper presented at the Proceedings of 4th International space syntax symposium, London

Din, M., Ullah, U., Qureshi, S.-u.-., Saqib, M. Z., & Ahmad, J. (2023). OBJECTIVE EVALUATION OF CPTED PRINCIPLES IN URBAN CONTEXT: A SYNTACTIC ANALYSIS OF HAYATABAD PESHAWAR. *International Journal of Contemporary Issues in Social Sciences. ISSN (E) 2959-2461 (P) 2959-3808, 2*(4), 123-130.

Dursun, P. (2007). *Space syntax in architectural design.* Paper presented at the Proceedings of 6th international space syntax symposium, Istanbul

Gardiner, R. A. (1978). *Design for safe neighborhoods: The environmental security planning and design process*: Department of Justice, Law Enforcement Assistance Administration, National ….

Hiller, B. (2005). The common language of space: a way of looking at the social, economic and environmental functioning of cities on a common basis. *Space Syntax Laboratory*.

Hillier, B. (1996). Space is the machine UK. In: Cambridge University Press.

Hillier, B., & Hanson, J. (1984). *The social logic of space*: Cambridge university press.

Hillier, B., Hanson, J., & Graham, H. (1987). Ideas are in things: an application of the space syntax method to discovering house genotypes. *Environment and Planning B: planning and design, 14*(4), 363-385.

Hillier, W., & Shu, S. (1999). Crime and urban layout: the need for evidence. In.

Jacobs, J. (1961). Jane jacobs. *The Death and Life of Great American Cities, 21*(1), 13-25.

Jeong, S. K., & Ban, Y. U. (2011). Computational algorithms to evaluate design solutions using Space Syntax. *Computer-Aided Design, 43*(6), 664-676.

Jones, M., & Fanek, M. (1997). *Crime in the urban environment.* Paper presented at the Proceedings of First International symposium on space syntax, London.

Klarqvist, B. (2015). A space syntax glossary. *NA, 6*(2).

López, M. J. (2005). *The spatial behavior of residential burglars.* Paper presented at the A. van Nes, Proceedings Space Syntax. 5th International Symposium, TU Delft, Techne Press, Delft.

Newspaper, A. s. N. G. (2003). Gosnells Wins the Fight Against Crime. *Australia's National Government Newspaper*. Retrieved from http://www.loc-gov-focus.aus.net/editions/2003/april/gosnells.shtml

Önder, D. E., & Gigi, Y. (2010). Reading urban spaces by the space-syntax method: A proposal for the South Haliç Region. *Cities, 27*(4), 260-271.

Penn, A. (2003). Space syntax and spatial cognition: or why the axial line? *Environment and behavior, 35*(1), 30-65.

Piombini, M. (1987). *Crime prevention through environmental design: The status and prospects for CPTED in British Columbia.* University of British Columbia,

Reid, S. T. (2017). *Crime and Criminology* (15 ed.): Aspen Publishing.

Rengert, G. (1980). Spatial aspects of criminal behavior. In *Crime: A spatial perspective* (pp. 47-57): Columbia University Press.

Shu, S. C., & Huang, J. N. (2003). *Spatial configuration and vulnerability of residential burglary: A case study of.* Paper presented at the Proceedings of 4th International Space Syntax Symposium, London.

Siegel, L. J. (2002). *Criminology: The Core*: Wadsworth Thomson Learning.

Steadman, P. (1983). Architectural morphology: an introduction to the geometry of building plans.

Taylor, R. B. (2003). Crime Prevention through Environmental. *Handbook of environmental psychology, 413*.

Turner, A., & Penn, A. (1999). *Making isovists syntactic: isovist integration analysis.* Paper presented at the 2nd International Symposium on Space Syntax, Brasilia.

Wineman, J., Peponis, J., & Dalton, R. (2006). Exploring, engaging, understanding in museums. *In: Space Syntax and Spatial Cognition Workshop: Spatial Cognition '06. Monograph Series of the Transregional Collaborative Research Center (2). Universität Bremen, Bremen.*, 33-51. Retrieved from https://nrl.northumbria.ac.uk/id/eprint/3902/