CRIME IN THE URBAN ENVIRONMENT

25

Dr Michael A Jones and Mamoun F Fanek
Texas Institute of Technology, Lubbock, United States

25.1

Keywords: crime, prevention, Space Syntax, American Cities

Mamoun F. Fanek
Land-use Planning, Management and Design (LPMD)
Texas Institute of Technology
4602 54th St. #246
Lubbock, Texas, 79414,
United States
tel: (1) 806 791-1755
e-mail: M.FANEK@ttu.edu

0 Abstract

The quality of life in urban settings is one of the most pressing issues in several fields, especially architecture and planning, politics, sociology, geography, and economics. A range of urban problems is blamed for the decline of the quality of life in our cities which include the increase of criminal incidence in core urban settings. In fact, crime is often considered the predominant urban problem. Many solutions have been employed to deter criminal activities. They include actions such as the deployment of more police, tougher laws, and stiffer jail sentences. Solutions were often based on the assumption that crime results from too many criminals and insufficient criminal justice, even though criminal indicators suggest that these approaches do not solve the problem. It is beginning to be recognised that the focus needs to shift to prevention rather than deterrence. According to the "criminometric models", many criminals act rationally, weighing the pros and cons of a criminal act. For example, by examining variables such as the size and range of potential gains, the ease and opportunity to commit the action, the degree of risk of being caught, and potential losses which include the size of monitory penalties and duration of imprisonment, economists are able to analyse and understand the rationality of criminal acts. There may be a direct correlation between the two variables, risk and opportunity, and the physical implications of certain urban design and planning actions. The recent emergence of the "Space Syntax" model now offers the architectural and planning professions, for the first time, a valid scientific and rigorous tool for evaluating existing and proposed design projects. The results from the few theoretical and real-world applications of research using the Space Syntax model are encouraging for they have demonstrated potential for enhancing a range of environments. It appears that many urban residential and commercial areas can be made more livable through designed circulation patterns that have the potential to improve levels of social interaction. If this is correct, such improvements may have further potential, that is of creating environments where it is difficult to commit criminal acts because of higher risks encountered by criminals as a consequence of the raised social physical interaction. Field research including site observations, photography, computation and other survey procedures has been carried out in two selected neighborhoods in a pilot study in Austin, Texas. Four pairs of Census Tracts were selected on the basis of similar demographic characteristics of each pair to eliminate or reduce factors other than spatial configuration on crime. This paper deals with the initial results from this investigation. Data collected from this research is analysed using Space Syntax techniques. As a result, a number of variables are obtained, including Global Integration, Control, Connectivity, Integration R=3, and Integration R=10. The relationship between these values and crime data is explored to examine their effect on enhancing the predictability of crime occurrence in urban environments.

25.2

1 Introduction

The quality of life in urban settings is one of the most pressing issues in several fields, especially architecture and planning, politics, sociology, geography, and economics. A range of urban problems is blamed for the decline of the quality of life in our cities which include the increase of criminal incidence in core urban settings. In fact, crime is often considered the predominant urban problem.

The recent emergence of the Space Syntax theory now offers the architectural and planning professions, for the first time, a valid scientific and rigorous tool for evaluating existing and proposed projects. The results from the few theoretical and real-world applications of research using the Space Syntax model are encouraging for they have demonstrated the potential for enhancing the quality of the environment for a range of situations. It appears that many urban residential and commercial areas can be made more livable through designed circulation patterns that have the potential to improve levels of social interaction. If this is correct, such improvements may have a further potential, that is of creating or modifying an environment in which it is more difficult to commit criminal acts because of the higher risks now encountered by criminals as a consequence of the raised social physical interaction.

This paper describes the initial results of a research study conducted by a PhD candidate in the Land-use Planning, Management and Design (LPMD) programme at Texas Tech University, College of Architecture. This research project will investigate the potential for the use of Space Syntax for improving our ability to predict criminal incidence in urban environments. There may be certain spatial characteristics which have an effect on increasing, decreasing, or maintaining the levels of criminal incidence. It is believed that these characteristics are linked to Space Syntax variables such as Integration, Connectivity, Control, Integration R=3, and Integration R=10. Axman, a software developed by the Unit for Architectural Studies (UAS) at University College London (UCL), was used in determining those variables in the case study below.

2 Background

Crime, from an economic point of view, is explained in terms of prices and incomes. Criminals are rational individuals who act in their own interest. In the process of deciding whether or not to commit a criminal act, criminals weigh the expected costs against the expected gains and benefits. The cost of crime to criminals includes the opportunity costs and the expected incarceration time if apprehended. The opportunity costs include the anticipated income that would have been earned if the time used in the planning and committing of the criminal activity had been devoted to legal, paying alternatives. The opportunity costs following apprehension and conviction for a crime are less for those living in poverty than for people from middle and upper level income groups. The latter certainly have more to lose in terms of real income and social status. The incidence of robbery and traffic in illegal goods tends to be high among members of minority groups subjected to the burden of both economic and social discrimination.

A number of publications have approached the issue of crime prevention through environmental design. These have focused on the physical attributes of the environment, such as improved lighting or the removal of barriers. Such measures are common sense issues in the area of crime prevention, as Charles Murray has stated:

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.

This view of the relationship between the physical environment and crime is widely accepted. The point that Murray makes about neighbours' participation in crime prevention and detection efforts is a plausible one. This participation is best achieved when neighbours actually know and can relate to each other. Organising neighbourhood watches alone cannot be expected to achieve these goals. It seems that regular social interaction and encounter are essential prerequisites for accomplishing the goals of knowing and relating to those in the neighbourhood.

3 Methodology

The City of Austin, Texas, visited by the researcher on several occasions, was selected for this research as the field study area for several reasons. They include: its relatively close proximity to Texas Tech University; it is the second fastest growing city in the United States; it offers encouraging cooperation, support, and enthusiasm of the Austin City Hall bureaucracy, Police Department, Chamber of Commerce and Texas Historical Commission; and there is ready availability and documentation of relevant data needed to carry out this research.

In order to conduct a precise analysis on the effects of the use of Space Syntax analysis on the predictability of crime occurrence in urban environments, there is a need to control variables to which crime occurrence is often attributed. By control, the researchers mean the selection of pairs of areas that have as close to identical demographic characteristics as possible. Because the availability of most data is based on the 1990 Census Tracts, the eight study area boundaries are based on those tracts.

Four pairs of areas defined by the 1990 Census Tracts in the City of Austin, Texas, have been chosen for the investigation. The paper deals with the initial results from investigation of the four pairs which include tracts 17.06 and 18.28, 18.32 and 17.22, 18.13 and 21.04 and 18.04 and 13.05, the identifications given in the Census Report for that city. The selection of a pair of areas is based on their having near to identical demographic characteristics including population, median household income, poverty rate, racial composition. Table 1 indicates the preliminary characteristics of the four pairs of areas anticipated for selection.

25.4

Table 1	Census Tracts							
	Pair I		Pair II		Pair III		Pair IV	
	17.06	18.28	18.32	17.22	18.13	21.04	18.04	13.05
Median Household Income	$45,978	$45,658	$31,719	$31,535	$22,612	$22,500	$17,182	$17,145
Poverty Rate	2.71	2.34	4.24	4.10	17.43	17.27	33.76	33.54

Population and Ethnicity 1990	Census Tracts							
	Pair I		Pair II		Pair III		Pair IV	
	17.06	18.28	18.32	17.22	18.13	21.04	18.04	13.05
Total Population	3,146	4,364	2,598	2,526	3,339	3,116	5,270	5,547
White	2,880	3,414	2,104	2,231	1,934	1,880	2,572	2,529
White % of Total	91.54%	78.23%	80.99%	88.32%	57.92%	60.33%	48.80%	45.59%
Black	73	274	232	58	761	599	668	400
Black % of Total	2.32%	6.28%	8.93%	2.30%	22.79%	19.22%	12.68%	7.21%
Hispanic	127	492	211	150	542	591	1713	2533
Hispanic % of Total	4.04%	11.27%	8.12%	5.94%	16.23%	18.97%	32.50%	45.66%
American Indian	6	5	3	6	6	13	22	16
Amer. Indian % of Total	0.19%	0.11%	0.12%	0.24%	0.18%	0.42%	0.42%	0.29%
Asian	59	177	46	80	86	31	275	58
Asian % of Total	1.88%	4.06%	1.77%	3.17%	2.58%	0.99%	5.22%	1.05%
Other	1	2	2	1	10	2	20	11
Other % of Total	0.03%	0.05%	0.08%	0.04%	0.30%	0.06%	0.38%	0.20%

Table 1. Demographic characteristics of selected areas.

Space Syntax analysis will be applied to each area using the Axman software. The resulting values for each respective area will be obtained, including Integration, Connectivity, Control, Integration R=3 and Integration R=10. The relationship between these values and crime data will be explored to examine their effect on enhancing the predictability of crime occurrence in urban environments. Based on this analysis, recommendations will be made.

4 Analysis

Based on the above mentioned selection criteria, four pairs of areas have been selected for investigation. Table 2 presents the crime data for the selected Census Tracts as study areas provided by the Austin Police Department:

Table 2	Census Tracts							
	Pair I		Pair II		Pair III		Pair IV	
Crime:	17.06	18.28	18.32	17.22	18.13	21.04	18.04	13.05
Murder	0	0	0	0	0	1	2	1
Rape	1	0	1	1	2	0	4	9
Robbery	0	1	4	2	19	15	18	38
Aggravated Assault	2	0	1	2	7	13	32	36
Burglary	32	32	3	25	66	51	95	126
Theft	80	71	34	326	387	186	354	408
Auto Theft	10	6	15	17	64	30	72	79
Arson	2	0	0	0	2	1	2	1
Total Indexed Crime	127	110	58	373	547	297	579	698
Indexed Crime per 1,000	40.4	25.2	22.3	147.7	163.8	95.3	109.9	125.8
Total Non-Indexed Crime*	80	125	62	225	396	247	748	1336
Non-Indexed Crime per 1,000	25.4	28.6	23.9	89.1	118.6	79.3	141.9	240.9
Total	207	235	120	598	943	544	1327	2034
Offenses per 1,000	65.8	53.8	46.2	236.7	282.4	174.6	251.8	366.7

**Non-Indexed Crime includes all other crime. Crimes include simple assaults, forgery, weapon violations, drugs, criminal mischief, public intoxication, disorderly conduct, city ordinances and many others.*

Source: Indexed and Non-Indexed Offenses by Census Tract, 01/01/95 Through to 12/31/95. Austin Police Department.

Table 2. Crime data for selected areas.

By visually examining the numbers in Table 2, it can be observed that there are noticeable differences in crime among the selected pairs of tracts. It also can be observed that the tracts characterised as higher crime areas have, for the most part, higher numbers in the different crime categories. There are a number of negligible cases where this does not apply. For instance, robbery occurred once in tract 18.28 and none in tract 17.06. The most noticeable deviance from the patterns of crime is that of tracts 18.13 and 21.04 in the area of aggravated assault where it occurred seven and thirteen times respectively. Generally, the overall pattern of crime is consistent. Overall higher crime areas can be characterised as having higher crime rates in most, if not all, crime categories.

Figure 1 illustrates the locations of the eight selected study areas in relation to the city using the axial map.

It also can be observed that each of the pairs of Census Tracts are relatively similar in terms of their demographic structure and are different in terms of their distribution of crime. The following is an investigation to determine whether spatial configurational properties can enhance our capability to predict high- and low-crime

Figure 1. Axial ap of Austin illustrating study areas.

areas. This can be accomplished by using Space Syntax methodology. A correlation between values obtained from Axman software and crime data will be investigated. Figure 2 is the axial map of the city of Austin illustrating the measure of Global Integration. The study areas are shown inside the boxes. The colour coding is based on red being high in integration and blue being low. The colours representing the transitional stages range from red to blue through to orange, yellow, green and cyan.

The following three Figures 3, 4, and 5 illustrate Integration R=3, Integration R=10, Connectivity and Control measures.

Figure 2. Austin,global integration map.
Figure 3. Austin, i ntegration R=3 map.

Figure 4. Austin, Integration R=10 Map.
Figure 5. Austin, Connectivity Map.

Table 3

Census Tract 17.06	Pair I	Line Count: 130			
	Integration	*Integration R=3*	*Integration R=10*	*Connectivity*	*Control*
Mean	0.5489693	1.7674828	0.9603840	3.0230769	1.0254365
Median	0.5467051	1.7239927	0.9651035	3.0000000	0.8500001
Average Deviation	0.0361856	0.5917999	0.1161904	1.2788166	0.5064341
Minimum	0.4604056	0.2109273	0.5966703	1.0000000	0.1428571
Maximum	0.7020287	4.4878879	1.3869444	14.0000000	4.1694446
Difference (Max-Min)	0.2416231	4.2769606	0.7902741	13.0000000	4.0265875

Census Tract 18.28		Line Count: 125			
	Integration	*Integration R=3*	*Integration R=10*	*Connectivity*	*Control*
Mean	0.5615698	2.1105858	1.0941107	3.4480000	1.0093884
Median	0.5607125	2.0206244	1.0920886	3.0000000	0.7833334
Average Deviation	0.0269534	0.5727162	0.0934569	1.4484480	0.5700964
Minimum	0.4777987	0.2109273	0.8066404	1.0000000	0.1000000
Maximum	0.6508103	4.7273822	1.4298884	16.0000000	4.8944440
Difference (Max-Min)	0.1730116	4.5164549	0.6232480	15.0000000	4.7944440

Census Tract 18.32	Pair II	Line Count: 71			
	Integration	*Integration R=3*	*Integration R=10*	*Connectivity*	*Control*
Mean	0.6210946	2.0738301	1.2034839	3.8028169	1.1471968
Median	0.6141884	1.9586495	1.1792116	3.0000000	0.8666667
Average Deviation	0.0334000	0.6943941	0.1308517	1.8682801	0.5820335
Minimum	0.5531862	0.5000312	0.9038395	1.0000000	0.1666667
Maximum	0.7700337	5.2668066	1.7652298	21.0000000	6.1123009
Difference (Max-Min)	0.2168475	4.7667754	0.8613903	20.0000000	5.9456342

Census Tract 17.22		Line Count: 73			
	Integration	*Integration R=3*	*Integration R=10*	*Connectivity*	*Control*
Mean	0.5603148	1.8275719	0.9622369	3.1232877	1.0505708
Median	0.5504827	1.8333938	0.8941960	3.0000000	0.9166667
Average Deviation	0.0589553	0.5899589	0.1822083	1.2340026	0.4673704
Minimum	0.4250245	0.2109273	0.6556100	1.0000000	0.1000000
Maximum	0.7247545	3.8814962	1.4858691	10.0000000	3.4916668
Difference (Max-Min)	0.2997300	3.6705689	0.8302591	9.0000000	3.3916668

Census Tract 18.13	Pair III	Line Count: 54			
	Integration	*Integration R=3*	*Integration R=10*	*Connectivity*	*Control*
Mean	0.6473379	2.1074458	1.3092745	3.7037037	1.1063572
Median	0.6443132	1.9910707	1.2955900	3.0000000	0.8666667
Average Deviation	0.0456046	0.6676167	0.1691299	1.8861454	0.6556538
Minimum	0.5273768	0.5000312	0.6892208	1.0000000	0.1428571
Maximum	0.7700337	5.2668066	1.7652298	21.0000000	6.1123009
Difference (Max-Min)	0.2426569	4.7667754	1.0760090	20.0000000	5.9694438

Census Tract 21.04		Line Count: 45			
	Integration	*Integration R=3*	*Integration R=10*	*Connectivity*	*Control*
Mean	0.6625712	2.8039085	1.4455358	4.5777778	1.0539241
Median	0.6698990	2.6541345	1.4584979	3.0000000	0.4954545
Average Deviation	0.0182617	0.6687436	0.0609215	2.8148148	0.8914636
Minimum	0.6169819	0.8725924	1.2496676	1.0000000	0.0500000
Maximum	0.7270585	5.3463230	1.6344389	22.0000000	6.8318181
Difference (Max-Min)	0.1100766	4.4737306	0.3847713	21.0000000	6.7818181

Census Tract 18.04	Pair IV	Line Count: 54			
	Integration	*Integration R=3*	*Integration R=10*	*Connectivity*	*Control*
Mean	0.6925050	2.6126963	1.4829539	5.1481481	1.3019058
Median	0.6836579	2.4919126	1.4625767	3.0000000	0.7777778
Average Deviation	0.0283909	0.9273310	0.1042931	3.6433471	0.9279898
Minimum	0.6343740	0.8725924	1.2465084	1.0000000	0.0909091
Maximum	0.7700337	5.9552150	1.7652298	31.0000000	7.4992065
Difference (Max-Min)	0.1356597	5.0826226	0.5187214	30.0000000	7.4082974

Census Tract 13.05		Line Count: 91			
	Integration	*Integration R=3*	*Integration R=10*	*Connectivity*	*Control*
Mean	0.6621310	2.8445656	1.4026941	5.2197802	1.0304304
Median	0.6639301	2.9709394	1.4063654	4.0000000	0.7619048
Average Deviation	0.0227665	0.7859210	0.0789256	2.9807994	0.6777993
Minimum	0.5772339	0.5000312	1.0305680	1.0000000	0.0588235
Maximum	0.7369588	5.7418194	1.6724807	28.0000000	5.0346384
Difference (Max-Min)	0.1597249	5.2417882	0.6419127	27.0000000	4.9758149

Table 3. Space syntax measurements for study areas.

The Global Integration, Integration R=3, Integration R=10, Connectivity and Control values were computed and extracted from the maps (Figures 2, 3, 4 and 5) using Axman software. Table 3 shows the values derived from these computations.

From the initial examination of Table 3, we can observe some consistencies between some of the values here and those of crime data in Table 2. For instance, all four pairs of study areas show higher Mean Integration and Mean Integration R=10 values associated with lower overall crime rates. Three of the four pairs show higher Mean Integration R=3 and Connectivity values associated with lower overall crime rates.

These observations are along the lines of previous research conducted by UAS in that higher Integration values, as well as Integration R=3 and Integration R=10, are usually associated with higher levels of movement at its different scales—pedestrian and vehicular. As a result of higher movement levels, lower levels of crime are expected, considering the fact that other factors influencing crime are, for the most part, controlled (as illustrated earlier). The assumption made here is that with higher levels of movement, levels of co-presence and co-awareness are expected to be higher. Consequently, more people—and eyes—are present in those public spaces that spell potential trouble for those attempting to commit any criminal act.

Table 4

Offenses per 1000	*12*	*190.5*	*107.8*	*114.9*			
Integration	*I*	*II*	*III*	*IV*	*r*	*t°*	*Significance*
Mean	0.012600452	0.060779797	0.015233319	0.867797298	0.030374016	2.469723046	90
Average Deviation	-0.009232172	-0.025555328	-0.027342902	0.005624377	-0.374788399	-0.571701978	-60
Minimum	0.0173931	0.1281617	0.0896051	0.0571401	0.945236958	4.09567657	95
Maximum	-0.0512184	0.0452792	-0.0429752	0.0330749	0.804785402	1.917459315	90
Integration R=3	*I*	*II*	*III*	*IV*	*r*	*t°*	*Significance*
Mean	0.343102948	0.246258239	0.696462692	-0.231869308	-0.149617286	-0.213999578	<-60
Average Deviation	-0.019083673	0.104435171	0.001126915	0.14141	0.689247744	1.34535387	80
Minimum	0	0.2891039	0.3725612	0.3725612	0.724248292	1.485400174	85
Maximum	0.2394943	1.3853104	0.0795164	0.2133956	0.71950883	1.465174405	85
Integration R=10	*I*	*II*	*III*	*IV*	*r*	*t°*	*Significance*
Mean	0.133726706	0.241246954	0.136261294	0.080259813	0.581212611	1.010085402	70
Average Deviation	-0.022733484	-0.051356506	-0.10820842	30.025367427	-0.173388702	-0.248979835	<-60
Minimum	0.2099701	0.2482295	0.5604468	0.2159404	0.10258196	0.145842182	<60
Maximum	0.042944	0.2793607	-0.1307909	0.0927491	0.542088697	0.912304866	70
Connectivity	*I*	*II*	*III*	*IV*	*r*	*t°*	*Significance*
Mean	0.424923077	0.67952923	0.874074074	-0.071632072	0.198632794	0.286620394	<60
Average Deviation	0.169631432	0.634277476	0.92866941	0.66254763	0.642947114	1.187168004	80
Minimum	0	0	0	0	#DIV/0!	#DIV/0!	N/A
Maximum	2	11	1	3	0.76198684	1.664028095	85
Control	*I*	*II*	*III*	*IV*	*r*	*t°*	*Significance*
Mean	-0.016048113	0.096626037	-0.052433085	0.271475456	0.372532156	0.567703749	60
Average Deviation	0.06366229	0.114663143	0.235809815	0.250190496	0.30684341	0.455936482	60
Minimum	-0.0428571	0.0666667	-0.0928571	0.0320856	0.618799798	1.114017541	80
Maximum	0.7249994	2.6206341	0.7195172	2.4645681	0.755361544	1.630137413	85

Table 4. Correlation between syntactic values and overall crime

Further examination of the data has revealed the following observations. As shown in Table 4, each value obtained through the Space Syntax methodology was examined separately. Areas showing higher overall crime rates were identified in each pair of Census Tracts—tracts 17.06, 17.22, 18.13 and 13.05. The syntactic values obtained from those tracts were subtracted from those showing lower overall crime rates—tracts 18.28, 18.32, 21.04 and 18.04. This allows us to identify the tracts with higher or lower syntactic values that are obtained using Space Syntax methodology. Following this, lower overall crime rates were subtracted from the higher overall crime rates for each pair of the Census Tracts. The purpose of this was to examine whether a correlation exists between the difference between syntactic values on the one hand, and the difference between overall crime rates on the other for the respective pairs of tracts shown in Table 4. The method used in this examination is the Pearson product-moment correlation coefficient (r). Using r, the t Distribution test was applied.

In the case of global integration, we find that the difference in the mean values within the respective tracts has a strong positive correlation with the difference in overall crime rates. If one area is characterised with higher global integration values than another area with similar demographic characteristics, it is more likely (90% significance) to experience higher overall crime rates. When the difference between the mean integration values of the two areas making up a pair is higher, the margin in overall crime rate is also higher. It should be noted that the area with the lower mean integration value of the pair has the higher overall crime rate, and vice versa.

By examining another value derived from this analysis—average deviation—we find the opposite is true with a lower level of significance (over 60% level of significance). Average deviation is a measure of the average difference between all values derived from one area and the mean of those values. This measure illustrates whether the range of values is high or low. If the range is high, it means the presence of greater extreme values. In the case of Global Integration, this appears to show whether an area is naturally integrated within the system. Table 4 indicates that the greater the difference in average deviation of the global integration between two areas with similar demographic characteristics, the higher the margin in overall crime rates between these respective areas.

In the case of Integration R=3, we find that the difference in the mean values within the respective tracts has a weak negative correlation with the difference in overall crime rates—less than 60% level of significance. Although, as mentioned earlier, tracts 18.28, 18.32 and 21.04 showing higher Mean Integration R=3 values than the other three tracts within their respective pairs are characterised with lower overall crime rates, wider margins in the mean values are not coupled with wider margins in overall crime rates. This may be explained by investigating the life styles of American people. For the most part, Americans prefer to use their own automobiles for the shortest conceivable trip. Walking is usually their last resort. As a result, Integration R=3 may not be an accurate representation of pedestrian movement in most American cities. The lack of pedestrian movement appears to result in higher opportunities for criminals to commit their acts without being detected.

25.10

Following the same argument, Integration R=10 demonstrated more representative results. The difference in the mean values within the respective tracts has a positive correlation with the difference in overall crime rates—more than 70% level of significance. If one area is characterised with higher Integration R=10 values than another area with similar demographic characteristics, it is more likely to experience lower overall crime rates. When the difference between the Mean Integration R=10 values of the two areas making up a pair is higher, the margin in overall crime rate is also higher. It should be noted that the area with the lower Mean Integration R=10 value of the pair has the higher overall crime rate, and vice versa. It appears that Integration R=10 illustrates an accurate representation of vehicular movement. At least in American cities, preliminary results indicate that the presence of more vehicular movement appears to be a limiting factor for creating the opportunity for criminal acts.

5 Conclusions

Previous research conducted by UAS reveals that higher pedestrian and vehicular movements are coupled with higher integration values, specifically Integration R=3 and Integration R=10. It is common sense that criminals, in general, do not prefer to work in environments where there are high risks of detection and apprehension. Risky environments for criminals include those where there is high use by citizens. Thus, lower crime rates should be expected in areas with higher values of Integration R=3 and Integration R=10. That was demonstrated in the cases of Global Integration and Integration R=10. However, Integration R=3 appears to show unfavorable results to this argument because, in general, most Americans prefer to use their private automobiles for most of their trips no matter how long or short those trips are.

The results of this study have suggested important observations and shed light on the effect of spatial configuration on the study of crime. A large sampling in different cities is needed to support these findings. However, Space Syntax methodology has provided us with a valuable tool that can assist researchers in improving their ability to predict high and low crime areas. Future research will investigate crime in more detail involving the different crime categories including murder, rape, robbery, aggravated assault, burglary, theft, auto theft and arson. A clearer picture will be formed on the effect of spatial configuration on those crimes separately.

In the United Kingdom, the police are more involved with building code regulation and planning ordinances than in the United States. Through this research and others like it in various parts of the world, a case might be made for the police in all countries to become more vigorously involved with architects and planners utilising Space Syntax methodology in the design of environments which are less prone to criminal activities.

References

Charles Murray, "The Physical Environment," *Crime* (San Francisco: Institute of Contemporary Studies, 1995), 349.
Eide, Erling, *Economics of Crime: Deterrence and Rational Offender*, New York: North-Holland, 1994.
Hillier, Bill. *Space is the Machine: A Configurational Theory of Architecture*. New York: Cambridge University Press, 1996.
Hillier, Bill. "In Defence of Space." *RIBA Journal* (November 1973): 539-544.

Hillier, Bill, and others. "Natural Movement: Or, Configuration and Attraction in Urban Pedestrian Movement." *Environment and Planning B: Planning and Design* 20 (January 1993): pp 29-66.
Hillier, Bill, and Penn, Alan, "Dense Civilisations: The Shape of Cities in the 21st Century." *Applied Energy 43* (1992): pp 41-66.
Hillier, Bill, and Penn, Alan, "Virtuous Circles, Building Sciences and the Science of Buildings: Using Computers to Integrate Product and Process in the Built Environment." *Design Studies* 15 (July 1994): pp 332-365.
Hillier, Bill, and Penn, Alan, "Visible Colleges: Structure and Randomness in the Place of Discovery." *Science in Context* 4 (1991): pp 23-49.
Hillier, Bill, and Hanson, Julienne, *The Social Logic of Space*. New York: Cambridge University Press, 1984.
Knox, Paul. *Urban Social Geography: An Introduction.* New York: Longman Scientific & Technical, 1995.
Peponis, John, and others. "The Spatial Core of Urban Culture." *Ekistics* 334 (January/February 1989): pp 43-55.
Peponis, John, "Space, Culture, and Urban Design in Late Modernism and After." *Ekistics* 334 (January/February 1989): pp 93-108.
Rubenstein, Ed. "The Economics of Crime: The Rational Criminal." *Vital Speeches of the Day* 62 (October 15, 1995): pp 19-21.
Sharp, Ansel M. and others. *Economics of Social Issues*. Chicago: Irwin, 1996.
Wilson, James Q. and Joan Petersilia. *Crime*. San Francisco: Institute for Contemporary Studies Press, 1995.