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THE SPATIAL FACTOR ANALYSIS FOR ANALYSING CRIME-RELATED ASSAULTS IN KUALA LUMPUR

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Abstract

This study analyzes the spatial factors that are contributive towards the occurrences of crime-related assaults in Kuala Lumpur. It is vital to identify what are the spatial factors that are closely associated with such violence. Therefore, the appropriate method for addressing the above problem is factor analysis. Data was collected from 442 samples of the census tract data in Kuala Lumpur. The data was converted into spatial data or spatial factors using Geography Information Systems (GIS) applications and grouped into three category groups of spatial factors which include (i) socio-demography, (ii) land use, and (iii) geographical factors. A principle component analysis was conducted on 28 items. The Kaiser Meyer Olkin (KMO) validated the sampling adequacy for the analysis, KMO=.80. There are 7 components that have eigen values more than 1 and in combination, are able to explain 78.66 percent of the variance. Values in the Rotated Component Matrix indicated that factor 1 has 14 items (socio-demographic features) while factor 2 has 11 items (land use and geographical features). Besides this, the Component Transformation Matrix shows that the correlations between factors are low, all of which are below .20(.16). This indicates that these 2 factors are independent and construct independently. Based on the results, 25 items from 2 major components can be used as a factor for predicting crime-related assaults.

Keywords: crime-related assault, spatial factors, factor analysis

Introduction

The unprecedented growth of the urban areas has characterized the urban areas with night time economy. The night time economy has fabricated the urban areas with a variety of nightlife activities including social and recreational, leisure and entertainment activities. Furthermore, the main source of concern of night time economy lies around the aspect of the entertainment establishments. It is observed that the geographical patterns and distribution of entertainment establishments such as pubs, bars, and nightclubs, etc. have greater impact towards the urban communities.

The geographical location of entertainment establishments are normally not randomly distributed around the urban areas and are specifically located in designated areas for business and commercial lots. As a part of prevention measures of crimes and other related problems, local authorities have allocated particular areas to be made entertainment establishments after anticipating the levels of density and accessibility. This involves buffering, zoning and planning control especially to minimize the adverse impacts of entertainment establishment's activities. For instance, limiting the number of establishments permitted within a given geographical area. Zoning is used to create buffer zones between establishments and urban facilities such as commercial and residential areas.

In recent years, the spatial distribution of entertainment establishments offers a spatial relationship in which people live and poses some problems people experience in different community settings. The availability of entertainment establishments in certain places may affect the people in the surrounding areas. These lead to the occurrences of social problems among the "urbanites" such as crime and violence, vandalism, heavy alcohol drinking, public nuisance, gambling, prostitution, and etc.

The neighbourhood characteristics are fundamentally important to examine the spatial interactions between geographical units. The related past studies show that socio-demographic factors have always been applied to establish the relationship with crime-related assaults. For instance, Scribner et al., (1995) focus on socio structure such as level of income, age, racial ethnic, rate of unemployment, the size of city, household size and female-headed household, while Gorman et al., (1998) have tested the unemployed, the median household income, Black, Latino, the ratio of men aged 20-29 years to 40-44 years old, number of households per 10,000 population, population and female-headed households per total households. Gruenewald et al., (2006) have conducted some empirical tests of the relationship between alcohol establishments and violence with statistical controls to correlates the characteristics of populations and places. They have also found that bars are

significantly related to crime and violence in the areas with poor and middle income groups of population. Land use factors are very much important for predicting crime and violence. Variations in land use certainly provide more spaces or even opportunities for various types of crime. For example Roman et al., (2008) in their study of alcohol outlets as causes of crime and violence have analysed land use factors such as the street light density, commercial and retail parcels, vacant parcels, bus stop density and metro stations. Meanwhile, Wuschke et al., (2009) explore the crime rates with land use purposes such as residential, farm, commercial, industrial, civic, institutional and recreational transportation, communication and utility. Furthermore, spatial aspects such as the density level of land use have been identified as a vital key for crime rates. The factors of place and location with the elements of accessibility and density have been closely linked with crime and violence. With regards to the scope of this research, numbers of past studies have proven that place and location factors are positively correlated with entertainment establishments such as pubs and bars towards the occurrences of crime and violence. For example based on the type of location, Nelson et al., (2001) have found out that 52% reported violent crimes in the city centre of Cardiff City take place in the public arena of the streets and they further note that establishment such as public houses, nightclubs, and other establishments account for a further 18% of incident locations. Meanwhile, Gruenewald (2004) has emphasized that the neighbourhoods adjacent to areas of high level of entertainment outlets have the likelihood to demonstrate high crime rates.

Apparently the socio-demography, land use, geographical factors are significantly vital in relation to the occurrences of crime-related assaults. Therefore this paper focuses on three groups of spatial variables for predicting the occurrences of crime-related assaults. Literature shows that these variables are closely related to the occurrences of crime. Nevertheless, this research will concentrate much from the spatial perspectives which include density and distance.

Theoritical Background

The thrust of this paper lies in the argument that the geographical locations of entertainment establishments are associated closely with crime-related assaults. It is widely acknowledged that the occurrences of assault are positively associated with entertainment establishments as well as being parallel with certain attitudes adopted in these places like heavy consumption of alcohol or binge drinking at these establishments. For example, substantial studies have found a positive relationship between the location of the entertainment establishments with hospital admissions, motor vehicle accidents, drunk driving, child abuse & neglect,

pedestrian injuries and mortality rates (see Green & Plant, 2008; Donnelly et al., 2006; Scribner et al., 1995; Livingston, 2008; Roman, 2008; Zhu et a.l, 2004).

Specifically, the researchers also have characterized the alcohol-related problems in or around the entertainment establishments with various types of crime and disorder such as criminal damage of property, assault and domestic violence (see Gruenewald et al., 2002; Gorman et al., 1998; and Briscoe & Donnelly, 2003), motor vehicle casualties and traffic fatalities (Vingilis et al., 2005; Cohen et al., 2001 and Bromley & Nelson, 2002), offensive behaviour (Dehan, 1999), littering, vomiting or urinating in the streets, noise and disturbance (Greater London Authority, 2002; Newton, 2008; and Wechsler et al., 2002); these are to name but a few.

The occurrence of crime and disorder around and within the entertainment establishments can be justified by a number of relevant crime-based theories. The criminal place theories provide a comprehensive understanding on how certain areas have high crime rates compared to other geographical areas. It can also explain why places such as pubs and bars are always associated with crime and disorder in particular with hot spot crime areas. It is widely accepted that pubs and bars have been recognized as a place that can attract crime. In general, crime place theories such as the Broken Windows Theory, Rational Activity Theory (RAT), and Social Disorganization Theory can describe how geographical features such as place, people and location have greater influence to the occurrence of crime in and around places such as entertainment establishments.

The Routine Activity Theory (RAT) has often been linked with the elements of place. The theory states that crime occurrences would happen when the following three elements come together in any given space and time: (i) an accessible target, (ii) the absence of capable guardians that could intervene, and (iii) the presence of a motivated offender. Felson and Clarke (1998) proposes that the targeted places such as residential areas, convenience stores, and business premises among others should have a value, inertia, access and visibility or better known as VIVA as to avoid any unfortunate incidences from taking place.

Meanwhile, the theory of social disorganization is applied to the explanation of crime and other social problems by sociologists at the University of Chicago in the early 1900s and can be defined in terms of absence or breakdown of certain types of relationships among people and the environment (Jensen, 2003). This theory is developed to examine crime patterns in major urban areas such as Chicago and other cities, and Herbert (1982) notes that the social disorganization theory predicts that large numbers of offenders in areas and among groups are normally typified by social disorganization.

Aim & Objectives

This study analyzes the spatial factors that can explain the tendency towards the occurrences of crime-related assaults in Kuala Lumpur. It is vital to identify what

are the spatial factors that are closely associated with this crime. Therefore, the appropriate method for addressing the above problem is factor analysis.

Approaches, Methods & Techniques

Data was collected from 442 samples of census blocks in Kuala Lumpur. The data was converted into the spatial data or spatial factors using the Geography Information Systems (GIS) applications and were grouped into 3 category groups of spatial factors which include (i) socio-demography, (ii) land use, and (iii) geographical factors. In view of the statistical analysis, the factor analysis will be used for selecting and compiling the independent variables into groups. The factor analysis is applied to identify underlying variables, or factors that explain the pattern of correlation in a set of observed variables. The factor analysis is often used in data reduction to identify a small number factor that explains most of the variance observed in a very large number of manifest variables. The factor analysis can be modelled and can be expressed as a linear combination of underlying factors. The statistical technique of the factor analysis is a multivariate statistical approach for selecting and identifying the variables into factors. Furthermore, factors that are not correlated with other unique factors and also the common factor itself can actually be described together with a combination of other variables that are observed.

Scale of Measurement

For factor analysis, the data collected should represent the normally distributed data. Thus, interval and ratio scale data are the most suitable. According to Field (2009), the assumption of normality is most important particularly to generalize the results of analysis beyond the sample collected. Referring to this research, all the sample data is on the secondary basis and the scale of measurement is the ratio and interval scale data.

Size of Sample

The literature shows that much has been discussed about the suitable and necessary sample size that can be selected for the factor analysis. There are various recommendations regarding the sample size in the factor analysis that have been proposed. For instance, Comrey and Lee (1992) recommend class 300 as a good sample size, 100 as poor and 1000 as excellent. Chua (2009) suggests that the minimum sample size should be 100. Meanwhile, Gorsuch (1983) proposes five subjects on the item, with a minimum of 100 subjects, regardless of the number of items. According to MacCallum et.al (1999), these rules are usually stated in terms of either the minimum required sample size, N, or the minimum ratio of N to the number of variables analyzed, p.

Another alternative approach is the Kaiser-Meyer-Olkin (KMO) which looks at the measure of the sampling adequacy. Small value of KMO statistic shows that the correlation between pairs of variables cannot be explained by other variables and also the fact that factors may not be accurate. It has also been emphasized that the KMO statistic varies between 0 and 1 whereby a value close to 1 indicates that patterns of correlations are relatively compact and thus, the factor analysis should yield distant and reliable factors (Field, 2009). On top of that, the advocates of this approach recommend that the accepting values greater than 0.5 are acceptable values for the sampling size.

Spatial Variables Identification

This research places emphasis on three groups of spatial variables for predicting the occurrences of crime-related assaults. The literature shows that these variables are closely related to the occurrences of crime. Nevertheless, this research will concentrate much from the spatial perspectives which include density and distance. In addition, all the non-spatial datasets are converted to the spatial datasets through the GIS processing. The identification of three components of spatial variables will be discussed below:

Socio-demographic Factors

Related past studies have shown that socio-demographic factors have always been applied to establish the relationship with crime-related assault. Apparently, the socio-demographic factors are significantly vital to explain the features and characteristics of a community. There are a number of past studies that have examined the factors of socio-demography as independent variables, in order to estimate the value of the dependent variable.

For example, Gruenewald & Remer (2006) use the socio-demographic factors such as population, household size, percentage of males, median household income, median age, percentage of African-Americans, percentage of Hispanics, and percentage of Asian to estimate assaults. Wechsler et al. al (2002) have examined the characteristics of socio-economy, such as annual household income, the percentage of African Americans, Hispanics, and White, home ownership, and individuals age 18-24 to estimate the effects of second-hand use of alcohol (noise and disturbance, vandalism, drinking, vomiting and urinating). Meanwhile, Donnelly et.al (2006) have examined variables such age group, gender, marital status, country of birth, labour force status and occupational group in a similar research paper.

The other related studies come from Scribner et al., (1995) who dwell on factors such as unemployment, ethnic/racial makeup, income, age, city size, household size and female headed household, Gorman et al., (1998) who specifically look at the unemployed, median household income, Black and Latino as the race factor, ratio of men age 20-29 years old to men 40-44 years old, number

of households per 10000 population, population and female-headed households per total households, Hansen & Brink (2004) who examine age and gender, Chikritzhs et al., (2007) who focus on total population, density population, urbanity index, unemployment rate, indigenous rate, usual residence 1 year ago that differs from the present residence, usual residence 5 year ago that differs from the present residence, one parent household rate, rate of house buyers, rate household income, average age, proportion of residents aged 60 years and older, ratio of adults to children, proportion of males aged 15-24 years and ratio of males to females.

Therefore, this paper will construct 14 socio-demographic variables based on the above literature (see Table 1). These variables are constructed upon four major aspects of socio-demography such as ages, races, the level education, and population. In detail, the ages include age between 14-19 years, age between 20-24 years, age between 25-29 years, age between 30-34 years and age 35-39 years. The race refers to three major races in Kuala Lumpur which include Malays, Chinese and Indians. The level of education includes never attending school, attending pre-school, attending primary school, attending secondary school, and attending high secondary school. Meanwhile, the population deals with the density population in every census district.

Table 1: Constructed Spatial Variables for Factor Analysis

Socio-Demography Factors	Land Use Factors	Geography Factors
Age between 15-19 years(age1)	Near distance to commercial land use(NearCommercial)	Near distance to establishments(NearOutlet)
Age between 20-24 years(age2)	Near distance to residential land use(NearResidential)	Near distance to pub and bar(NearPubBar)
Age between 25-29 years(age3)	Near distance to public facility(NearPublicFacility)	Near distance to pub(NearPub)
Age between 30-34 years(age4)	Near distance to recreation land use(NearRecreation)	Near distance to pub and restaurant(NearPubRest)
Age between 35-39 years(age5)	Near distance to terminal land use(NearTerminal)	Near distance to disco(NearDisco)
Malays(Race1)	Near distance to school or institution(NearSchool)	Near distance to hotel(NearHotel)
Chinese(Race4)		Near distance to other establishments(NearOthers)
Indians(Race5)		Near distance to the police stations(NearPolice)
Never attending school(School1)		
Attending pre-school(School2)		
Attending primary school(School3)		
Attending lower secondary school(School4)		
Attending high secondary school(School5)		
Population(Population)		

Land use Factors

Land use factors are very much important for predicting crime rates. Variations in land use certainly provide more spaces and chances for various types of crime. Furthermore, spatial aspects such as the density level of land use have been identified as a vital key for crime rates. There are various past studies that specifically highlight land use and crime rates. Roman et al., (2008) in their study of alcohol outlets as attractors of violence and & disorder have examined a few land use factors such as street light density, commercial and retail parcels, vacant parcels, bus stop density and metro stations. Kathryn et al., (2009) in turn, have spent some time to explore the crime rates with land use purposes such as residential, farm, commercial, industrial, civic, institutional and recreational, transportation, communication and utility.

Browning et al., (2010) concentrate on the density of commercial areas and the concentration of residential land use to establish a relationship with crime in urban neighbourhoods. Lockwood (2007) examines the land uses such as rental, retail/office/commercial, or public and institutional property to predict the violent crime rates in Savannah. McCord et al., (2007) resort to examine land-use street addresses in their study of non-residential crime attractors and generators that can elevate perceived neighbourhood crime and incivilities.

Evidently, the variety of land uses has significantly contributed to the number of crime rates. Therefore, based on literature, this study will examine various land use factors that have been converted to the spatial data. As part of the spatial data, this study has constructed six land use factors and calculated their near distances from the centroid points. Centroid point is defined as the focal point of each census district in Kuala Lumpur. These variables include near distance to commercial land use, near distance to residential land use, near distance to public facility, near distance to recreation land use, near distance to terminal land use, and near distance to school or institution (see Table 1).

Geography Factors

Geographical factors significantly contribute to the number of crime occurrences. Geographical factors such as place and location, density, accessibility and distance have been closely linked with crime occurrences. With regards to the scope of this research, numbers of past studies have proven that geographical factors are positively correlated with entertainment establishments such as pubs and bars towards the occurrences of crime. For example high level concentration of licensed premises or entertainment outlets has always been associated with alcohol related problems including crime and violence (Hill, 2007, Gruenewald et al., 2000, Livingston et al. 2007, Treno et al., 2007, and Livingston, 2008). Meanwhile, Gruenewald (2004) emphasizes that the neighbourhoods adjacent to areas of high number of entertainment outlets are commonly prone to high crime rates.

Britt et al., (2005) have conducted a study on the neighborhood level spatial analysis of the relationship between alcohol outlet density and criminal violence. Their findings indicate a significant positive relationship between alcohol outlet density and violent crime. Similarly, Lipton & Gruenwald (2002) have studied whether the association between violence and population density is moderated by the presence of alcohol outlets, both within a target geographical area and in adjacent geographical areas.

The above literature shows that geographical factors are the main variables that can be correlated with crime occurrences. Therefore this study has constructed eight geographical factors from the two key areas namely types of entertainment establishments and police stations. In addition, this study emphasizes the distance between the centroid points of the given census districts with entertainment venues and police stations. These variables include near distance to entertainment outlets, near distance to pub and bar, near distance to pub, near distance to pub and restaurant, near distance to disco, near distance to hotel, near distance to other establishments and near distance to the police stations (see Table 1).

Hypothesis Statement

The hypothesis statement will be established prior to the conduct of the factor analysis. The hypothesis statements are outlined below:

i. Null Hypothesis: The proposed variables that influence crime-related assault are uni-dimensional.
ii. Research Hypothesis: The proposed variables that influence crime-related assault are multi-dimensional.

Results & Interpretations

In spatial statistics, data is represented and measured by geographical features such as density and distance. The location of places and areas are processed and examined by the applications of the GIS to produce variables which are characterized by density and distance. In the context of this research, the socio-demographic factors are measured in density while the land use and geographical factors are measured in distance.

Descriptive measures of the spatial data are important especially when it comes to comprehending and examining the spatial features such as density and distance. The first output from the analysis is a table of descriptive statistics for all the variables under examination. Table 5.2 shows 28 variables that are measured in density and distance. Typically, the *mean*, *standard deviation* and *number of samples* (N) which were selected in the analysis are given. Looking at the *mean*, one can conclude that *Chinese (Race4)* and *Near distance to pub and bar (NearPubBar)* are the most important variables that influence crime related assault with each contributing the *mean* of .1933 and 1893.2659, respectively.

The next output of the analysis is the correlation coefficient. A correlation matrix is just a rectangular range of numbers which gives correlation coefficients between a single variable and all other variables in the investigation. The correlation coefficient between a variable and itself is always 1, which is why the main diagonal of the correlation matrix contains 1s. The correlation coefficients above and below the main diagonal is the same.

The KMO test exhibits multicollinearity. If the same correlation exists between two or more items, this indicates that the items are measuring the same aspects. The KMO test helps researchers to determine whether each item is appropriate or otherwise, to test the factor analysis. The accuracy of the sample size can be dictated if the KMO values are greater than .50 or .30. In this case, the KMO value indicates that the data have no serious multicollinearity problem. Therefore, those items suitable for the factor analysis have been selected. Meanwhile the Bartlett's Test of Sphericity was used to identify whether the correlation between the items is sufficient for the factor analysis to be carried out. Results of these tests are significant at p <.05, showing the correlation among the items available for the factor analysis.

Table 2: Total Variance Explained Output

Component		Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
DIMENSION0	1	9.948	35.530	35.530	9.948	35.530	35.530	9.167	32.738	32.738
	2	3.996	14.273	49.803	3.996	14.273	49.803	2.619	9.355	42.093
	3	2.359	8.426	58.229	2.359	8.426	58.229	2.616	9.344	51.437
	4	1.759	6.284	64.513	1.759	6.284	64.513	2.166	7.737	59.174
	5	1.403	5.012	69.525	1.403	5.012	69.525	1.899	6.782	65.956
	6	1.379	4.925	74.450	1.379	4.925	74.450	1.800	6.428	72.384
	7	1.178	4.207	78.657	1.178	4.207	78.657	1.757	6.273	78.657
	8	.813	2.905	81.562						
	9	.767	2.740	84.302						
	10	.708	2.530	86.832						
	11	.604	2.159	88.991						
	12	.590	2.109	91.099						
	13	.493	1.761	92.860						
	14	.473	1.688	94.548						
	15	.341	1.217	95.766						
	16	.258	.922	96.687						
	17	.206	.737	97.424						
	18	.173	.617	98.041						
	19	.155	.555	98.596						
	20	.092	.328	98.924						
	21	.091	.324	99.247						
	22	.057	.202	99.450						
	23	.050	.178	99.628						
	24	.042	.150	99.778						
	25	.028	.099	99.877						
	26	.018	.065	99.941						
	27	.013	.045	99.986						
	28	.004	.014	100.000						

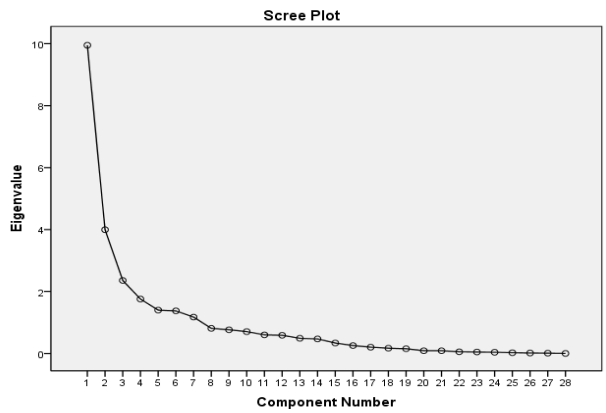
The output of the communalities table shows how many different variables are taken into account by the factors extracted. The principle component analysis works on the initial assumption that all variance is common. Therefore, before the extraction, all communalities are 1. However after the extraction, some of the factors are removed. The amount of variance in each variable that can be explained by the retained factors is represented by the communalities after extraction.

As shown in Table 2, there are seven components (factors) which give an eigenvalue greater than 1. Seven factors account for 78.6 percent of the total variance changes (the occurrence of assault-related crimes). By contrast, there are 21 components accounting for only 21.4 per cent variance of the dependent variable. However, there are five factors which are above the variance contribute more than 5 percent of component 1 (35.5 percent), component 2 (14.2 percent), component 3 (8.4 percent), component 4 (6.3 percent) and component 5 (5 percent).

Obviously the first factor explains relatively large amounts of variance whereas the other factors explain only small amounts of variance. Before the *Rotation Sums of Squared Loadings*, the factor 1 accounts for considerably more variance than the remaining six (35.530 percent compared to 14.273, 8.426, 6.284, 5.012, 4.925 and 4.207). Nevertheless, after the extraction, it accounts for 32.738 percent of variance.

The graph of Scree Plot in Figure 1, demonstrates variables with high and low eigenvalues. By graphing through the Scree Plot, we will be able to obtain as many factors as there are variables and each has an associated eigenvalue. Based on the above graph, the cut-off point or point of inflexion is where the slope of the line changes dramatically. Therefore, in Figure 1.0, the point of inflexion converges at the third data point (factor). Hence, only factors to the left of the point of the inflexion will be extracted. In view of more than 400 samples, the scree plot provides accuracy and standard for the factor selection.

Figure 1: Graph of Scree Plot



Based on the result of the *Total Variance Explained* and scree plot graphing, two major factors have been identified. Furthermore, the next step is to identify the variables that are loaded onto each factor. Therefore, the researcher has to rerun the factor analysis beginning with the dialog box of extraction whereby two factors are dictated. The other steps are similar to the first factor analysis, except for the dialog box extraction. According to Kinnear & Gray (2000), when the factors are uncorrelated with each other, the factor loadings are the partial correlation coefficients between variables and the factors. Therefore, the higher the absolute value of loading, the more the factor accounts for the total variance of scores on the variable concerned. The matrix component for the analysis factor component is the unrotated factor matrix, which is difficult to analyze.

Table 3: Rotated Component Matrix

	Component	
	1	2
POPULATION	.986	
AGE5	.947	
SCHOOL1	.945	
AGE4	.927	
SCHOOL3	.921	
SCHOOL5	.918	
SCHOOL4	.914	
AGE3	.906	
SCHOOL2	.888	
AGE1	.646	
RACE4	.639	
RACE5	.633	
RACE1	.615	
AGE2	.596	
NEARPUBFACILITY		
NEARBAR		.726
NEARHOTEL		.716
NEARTERMINAL		.665
NEAROTHERS		.653
NEARDISCO		.639
NEARPUBBAR		.608
NEARPOLICE		.586
NEARPUBREST		.565
NEAROUTLET		.522
NEARCOMMERCIAL		.402
NEARSCHOOL		.399
NEARRESIDENTIAL		
NEARRECREATION		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

Table 3 displays the rotated factor (component) matrix which should be compared with the unrotated matrix. As shown Table 3, the *Rotated Component*

Matrix shows the correlations between variables with two factors. Evidently, factor 1 contains 14 variables (Population, Age5, School1, Age4, School3, School5, School4, Age3, School2, Age1, Race4, Race5, Race1, Age2), and factor 2 retains 11 variables (NearBar, NearHotel, NearTerminal, NearOthers, NearDisco, NearPubBar, NearPolice, NearPubRest, NearOutlets, NearCommercial and NearSchool). Apparently 3 variables have been eliminated, namely NearPublicFacility, NearResidential, and NearRecreation. Thus, these three variables are not suitable to be used for predicting the crime related assault. Notably the values of the coefficient correlation for these eliminated variables are not expressed and this indicates the values of these variables that are smaller than .33.

Table 4 shows the correlations between two factors which are relatively low (below .20 or .16). Therefore these two factors are independent in a way that they can stand alone as a construct.

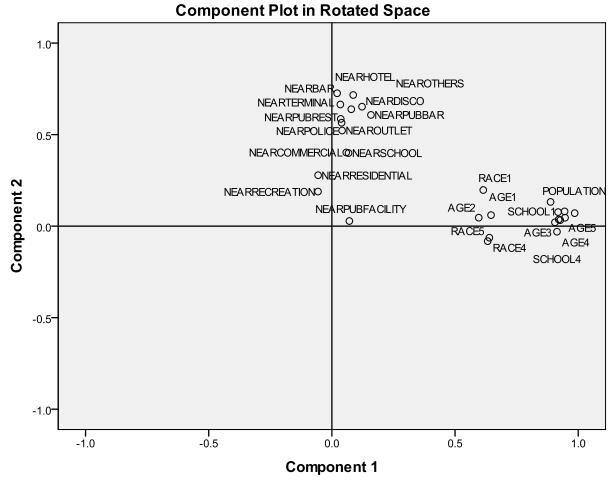
Table 4: Component Transformation Matrix

Component	1	2
1	.987	.161
-2	-.161	.987

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Figure 2 clearly demonstrates the distribution of rotated 28 variables in 2 dimensions. Obviously the eliminated variables such as NearPubFacility, NearRecreation and NearResidential are some distance away from both components.

Figure 2: Component Plot in Rotated Space



Conclusions

In summary, there are proposed 28 spatial variables that have been analyzed in the factor analysis. The eigenvalues and scree plot clearly indicate that these variables are multi-dimensional. Based on these results, the researcher rejects the null hypothesis and decides that the variables have been proposed to form more than one construct. Through the varimax rotation procedure, the table rotated component matrix shows that the variables proposed are in a two-dimensional form (i.e containing two factors), where two factors are extracted from the proposed variables.

Results of further analysis have shown that these two factors account for 42 percent of the total variance (factor 1: 32,738 percent; factor 2: 9355 per cent) after the varimax rotation is performed. The value of the *Rotated Component Matrix* shows that factor 1 maintains 14 variables and factor 2 maintains 11 variables. In the meantime, there are three variables removed as a coefficient of less than .33. In addition, the correlations between these two factors (.16) are shown in the Component Transformation Matrix Table of less than .20, which indicates that the two factors are independent of each other. Results show that the variables proposed for predicting the occurrence of crime-related assaults can be used. Results also exhibit that there are 14 variables that are grouped according to socio-demography. On the other hand, there are 11 variables grouped according to the factors of land use and geographical factors.

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