TEMPORAL AND SPATIAL ANALYSIS OF CRIME
IN SEOUL, KOREA

by

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B.A., Korea National Police University, 1994

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Abstract

Environmental criminology is a field that is growing and evolving in western societies. However, there are few works by either western criminologists or eastern scholars on crime patterns in oriental countries, including Korea. Inspired by this deficiency, crime data from Seoul, Korea was analyzed to confirm whether the established theories and findings of environmental criminology in western countries hold for Korea as well. The results of these analyses verified that there are stable temporal and spatial patterns in crime that exist in Seoul.

For the purpose of examining more comprehensive crime patterns, synthetic temporal-spatial analysis was employed. Temporal and spatial analysis could be linked by the idea of "dynamic place." Dynamic place means that the sense of place is not static but dynamic; that is, it varies according to the flow of time. The criminality of a place can be alleged for only some specific time period. Through analysis, it was verified that crime hot spots are "hot" only during definite times.
Dedication

I would like to dedicate this work to my daughter Su-Jeoung. She is my life and the reason why I exist. Without her, I could not have surmounted all of the difficulties with which I had been faced. I make a definite promise that I will live for her for my whole life.

My special thank you and gratitude goes to my parents and brothers. When I became discouraged, all of them encouraged me not to give up. Their love and encouragement was very helpful. I will never forget their love.

Lastly, I would like to extend my appreciation to Professor Chul-Sue Hwang and Mr. Sang-Hun Jeoung. Their assistance was a great support for my work.

이 논문을 저의 사랑하는 딸 "수정"에게 바칩니다. 만약 수정이가 없었다면 그 동안 겪었던 많은 어려움들을 이겨낼 수 있었을까 의문입니다. 아빠가 공부에 바쁜다는 평계로 가장 아빠의 사랑을 받아야 할 시기에 비록 몇 개월이나마 아빠와 떨어져 있게 된 내 딸에게 미안하다는 말과 함께 이 영광을 돌리고 싶습니다. 그리고, 가슴속 깊이 사랑한다는 말을 전하고 싶습니다.

또한 제 부모님과 형님들(임길환, 임형환 님)의 깊은 사랑과 격려에 큰 감사를 드립니다. 제가 힘들고 어려울 때 그 분들은 항상 저를 격려해 주고 협이 되어 주셨습니다.

마지막으로, 경희대 황철수 교수님과 정상훈군의 현신적인 도움에 깊은 감사를 드립니다.
Acknowledgements

To my senior supervisor, Dr. Paul J. Brantingham, I would like to express my deep gratitude for the support and assistance you have provided me throughout this process. The opportunity to work alongside him has been invaluable and an enjoyable experience.

I would also like to express my gratitude to Dr. Raymond R. Corrado for his assistance with this project.
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Chapter One: Introduction

Throughout human history there have been a number of attempts to explore the problem of crime and ways of solving it. Classical criminologists assumed that criminal motivation was always the same; a rational calculation of self interest (Brantingham and Jeffery, 1991). Jeremy Bentham, a forerunner of Classicism asserted:

Nature has placed mankind under the governance of two sovereign masters, “pain and pleasure.” They govern us in all we do, in all we say, in all we think. (Bentham, 1965: 1).

Accordingly, they had been concerned with the legal definition of criminal acts and with the elaboration of fair and efficient criminal justice agencies (Brantingham and Jeffery, 1991).

For positive criminologists, the critical dimension of the criminal event became the offender. The study of the offender’s biology, psychology, and social situations became the focus of a search for the combination of forces, pressures, situations, and experiences that motivate people to commit specific forms of criminal behaviour (ibid.).

From the 1920s to 1970s, sociological positivists gave priority to environmental rather than individual elements as the force shaping criminal behaviours. Put succinctly, a characteristic common to the above positions is that the central research field of criminology was the problem of offender motivation.
However, since the 1970s, a remarkable change has occurred. There has been an intense proliferation of theoretical approaches giving priority to the environment as a direct factor influencing criminal events. These approaches can be referred to as "contemporary environmental criminology" encompassing the following characteristics: (1) a shift from a disciplinary to a criminological relationship, (2) a shift from a concern with offender motives to a concern with criminological events, and (3) a shift from the sociological to the geographic imagination (Brantingham & Brantingham, 1991b).

Today, environmental criminology is a field that is growing and evolving in western societies (Brantingham & Brantingham, 1991d). However, this is not true in the case of Asia. Even though a lot of research has been done in this field on crime phenomena in western societies, there are few works by either western criminologists or eastern scholars on crime patterns in oriental countries, including Korea. Being inspired by such deficiency in the environmental criminology research, I have chosen to analyze the crime problem in Seoul, the capital of Korea, using the perspective of environmental criminology.

Ronald V. Clarke (1995) argues that crime prevention measures which work in one setting may not do so in another, so much detailed thought has to be put into the design and implementation of such measures. They have to be carefully tailored to the settings in which they are applied, with due regard to the motives and methods of the offenders involved (ibid.). That is, for the purpose of developing efficient crime prevention policies, it is a prerequisite to obtain adequate information about crime patterns and criminals in a city, precinct, or country where they are to be applied. This
can be solved by the approaches of environmental criminology which have generated numerous theories and ample information about crime patterns, motives, and methods of offenders. This pragmatic superiority of environmental criminology also encouraged me to search for appropriate crime prevention policies by analyzing crime data in Seoul.

Regarding the purposes of my thesis, first, I will explore whether the established theories and findings of environmental criminology in western countries can hold for Korea as well.

Second, by virtue of analyzing and understanding the crime patterns of Seoul, I will attempt to present proper counter-crime polices on the basis of "Problem-Oriented Policing."
Chapter Two: 
Theoretical Framework: Environmental Criminology

Intellectual Heritage of Environmental Criminology

Crime has always shown an uneven geographical distribution; for example, rural areas traditionally have less crime than urban areas. The uneven distribution of crime was first noted by Guerry (1833) and Quetelet (1835) (Einstadter & Henry, 1995). They analyzed the early French criminal statistics and found: (1) crime was not homogeneously distributed across the departments of the country; (2) the patterns of violent crime and property crime differed substantially; (3) these general patterns were stable over time; and (4) spatial variance was a fact at multinational levels as well as within a country (Brantingham & Brantingham, 1991b). These discoveries triggered research on the environment as a factor contributing to the causes of crime.

In the early twentieth century, social positivists (or early environmental criminologists) such as Robert E. Park, Ernest W. Burgess, Clifford R. Shaw, Henry D. McKay, Amos Hawley, and Terrence Morris developed the legacy further, even if the environment was considered as a second-hand factor explaining the motivation of criminals. Clifford Shaw and Henry McKay (1942), representatives of the Chicago School of sociology’s approach, found that in Chicago the rates of delinquency for many years had remained relatively constant in the areas adjacent to centres of commerce and
heavy industry, despite successive changes in the nativity and nationality composition of the population. They concluded that the delinquency-producing factor was inherent in the community (Shaw & McKay, 1942). From their perspectives, however, environment had "indirect" relevance to crime because it was assumed to be a force which shapes human behaviour (including criminal behaviour), rather than independent dimensions of the criminal event.

Arguing that crime has the four dimensions of law, the offender, the target, and the place, contemporary environmental criminologists critique the traditional approaches to criminology for emphasizing only offender-focused factors and ignoring three of the dimensions of the criminal event (Brantingham & Brantingham, 1991b). Jeffery (1977) argued that direct research on the other dimensions might prove more useful when the scholarly objective was an understanding of crime rather than criminality, and the policy objective was crime control rather than offender control.

Recent environmental criminologists see crime as a product of the interaction between a potential offender and the immediate and distal environment, and thus, explore how actual criminal events involve an interaction between motivated individuals and the surrounding social, economic, legal, and physical environment (Brantingham & Brantingham, 1998).

The work tended to follow two analytic paths. Studies following the first path focused on an objective analysis of the spatial and temporal variation in crime patterns in
order to discover aggregate factors influencing the patterns (Brantingham & Brantingham, 1991d). Spatial and temporal clustering of crime has been repeatedly shown (see Guerry, 1831; Quetelet, 1842; Shaw & McKay 1969; Brantingham & Brantingham, 1991a). A variety of factors have been considered to account for spatial and temporal variations in crime.

It has been argued that crime rates vary quite substantially by land-use type. For example, particular types of land uses such as fast food restaurants (Brantingham and Brantingham, 1991a), bars (Roncek and Pravatiner, 1989) and high schools (Roncek and Lobosoco, 1983) have been found to be criminogenic. Peter Engstad (1971) explored crime patterns around bars and shopping malls for the year 1968 and found clear crime patterns centered around these high population areas.Polling areas containing bars had much higher crime rates than surrounding areas without bars (Brantingham and Brantingham, 1991d). Street networks along with traffic and transit patterns strongly affect the distribution of crimes (Beavon, 1984).

Studies following the second analytic path focus on a subjective analysis of why criminals choose some locations or some victims in preference to others (Brantingham & Brantingham, 1991d).

Routine activity theory states that predatory crime occurs when a likely offender and suitable target come together in time and space, without a capable guardian present (Cohen & Felson, 1979). It takes the existence of a likely offender for granted since normal human greed and selfishness are considered to be sufficient explanations of criminal motivation (ibid). Targets are created in many ways. The potential target should
have an attractiveness and be suitable to the offender committing the crime. Absence of guardians is the third element that facilitates the commission of crime (ibid.). This theory can be a powerful tool to explore the factors to facilitate crime in a hot spot.

Rational choice theory argues that criminals are seeking to benefit themselves by their crimes, which is rational enough, not assuming that offenders are perfectly rational in planning and committing their crimes (Cornish & Clarke, 1986). Offenders are posited to behave under limited or bounded rationality.

**Terminology of Environmental Criminology**

A crime occurs when four things are in concurrence: a law, an offender, a target, and a place. (Brantingham & Brantingham, 1991b). The Brantinghams (1991a) describe these four elements as the four dimensions of crime and define environmental criminology as the study of the fourth dimension of crime: the place, which carries with it more meanings than simply “location.”

**Pondering on the Notion of Place**

“The place” is defined as a discrete location in time and space at which the other three dimensions intersect and a criminal event occurs (Brantingham and Brantingham, 1991b). The Brantinghams’ description of a place includes the concept that a crime location also has a discrete locality in time (Ratcliffe, 2002); nevertheless, a huge portion of research and studies in environmental criminology have been biased toward only a spatial analysis of crime. The development of Geographical Information Systems (GIS) and the popularity of crime mapping among criminal justice practitioners have further emphasized the attention on the spatial dimensions of crime (Buckley, 1996; Harris 1999).
This should not be so. The sense of place is not static but dynamic; that is, it varies according to the flow of time. The criminality of a place can be alleged for only some specific time period; at other periods this place is as “normal” or crime free as any other (Rengert and Wasilchick, 1985). For example, people frequently feel fear in an underground parking garage late at night, but feel little or no fear in the same location during the day (Brantingham, Brantingham, & Seagrave, 1995).

To sum up, crime hot spots are “hot” only during definite times. In other words, hot spots go together with “burning” times (Verma & Lodha, 2002). “Hot spots” or “burning times” are really clusters of crimes in different dimensions, namely, space and time (ibid.). Accordingly, space and time must be considered simultaneously to get more comprehensive crime patterns of a certain place. Therefore, in addition to the spatial analysis of crime, temporal aspects of the crime pattern need to be explored.

Levels of Analysis

The Brantinghams (1991b) break down contemporary environmental criminology discussions into three levels of analysis: macro, meso, and micro.

Macro-analysis involves studies at the highest levels of spatial aggregation such as countries, states, provinces, or cities (Brantingham and Brantingham, 1991b). Meso-analysis involves the study of crime within the subareas of a city or metropolis, such as the constituent cities of a metropolitan area, police precincts, or census tracts (ibid.). Micro-analysis involves the study of specific crime sites (ibid.).
In my thesis, one police precinct of Seoul, which is the metropolis of Korea, will be analyzed; accordingly, this will be a meso-level analysis.

Meso-level research involves examining the distribution of crimes in relation to the distribution of targets; of routine daily activities such as work, school, shopping, and recreation locations; of criminal justice system; of traffic channels; and of zoned land uses (Brantingham and Brantingham, 1991b).
Chapter Three:  
The Task Environment of Criminal Justice in Korea

A task environment is the cultural, social, geographic, and community setting in which the criminal justice system operates and criminal justice personnel make decisions (Griffiths & Cunningham, 2003). The characteristics of a particular task environment influence the types of crime and social disorder, the decision-making options that are available, the effectiveness of justice policies and programs, and the potential for developing community-based programs and services (ibid.). Therefore, in order to understand the crime phenomena in a country, one needs to know about the political, social, cultural, economic, and geographic environments of the country.

Geographic, Demographic, and Political Features of Korea

The Republic of Korea is on the north eastern part of the Asian continent. It is located between 33 degrees and 43 degrees in Northern Latitude, and 124 degrees and 132 degrees in Eastern Longitude. Korea covers 77,006 square kilometres. China, Russia, and Japan are adjacent to Korea. Local time is nine hours ahead of GMT (KNSO, 2004). The population of Korea in 2003 was 47,925,318 (ibid.).

Korea is divided into 7 metropolitan cities and 9 provinces (ibid.). The Republic of Korea has a democratic form of government based on the separation of powers and a system of checks and balances. The Government consists of three branches: the
legislature, in the form of a unicameral National Assembly; the judiciary, consisting of
district and appellate courts and the Supreme Court; and the executive, headed by the
President who is the head of state and commander-in-chief of the Armed Forces. The
President is assisted by the Prime Minister and the State Council. Figure 1 shows the
political map of Korea.

Figure 1: A political map of Korea

Since the 1970s, Korea has experienced rapid changes. The total population increased 53% over the past 30 years (Lee, Park, and Son, 2004). Rapid modernization and urbanization has occurred. In the 1960s, 35% of people lived in a city. More than 85% of the population lived in a city in 1995 (ibid.). The national economy developed greatly in recent years. For example, the Per Capita GNI (Gross National Income) was $272 in 1970 and became $12,646 in 2003 (KNSO, 2004).

The Criminal Justice System and Crime Statistics in Korea

The criminal justice system of Korea is a continental system, so it is very similar to that of Germany. The judiciary of Korea is responsible for judgment and the Public Prosecutors' Office is in charge of indictment, and sometimes investigation. The Korean National Police investigates crime and arrests offenders. All of these are nationwide public organizations, and each works under one hierarchy respectively.

Crime statistics are generated by the Supreme Public Prosecutors' Office (SPPO) and the Korean National Police Agency (KNPA). For the most part, crime data generated by KNPA will be used in my thesis.

Under the Korean Crime Classification Code, there are two major groups: penal law offences and special law offences. Penal law offences involve property crime, violent crime, forgery & counterfeiting crime, government officials' crime, negligence crime, and moral crime. Special law offences include crimes against various special laws. For example, traffic crime is included in special law offences because it is against "The Special Law Processing Traffic Accident." In general, the ratio of penal law offences to special law offences is six to four. The KNPA are especially interested in five common
crimes: murder, robbery, rape, theft, and violence because they are a public barometer by which levels of crime are measured (Gill, 2000).

**The Korean National Police Agency**

The KNPA is comprised of the Headquarters of the National Police Agency, the Central Police Organization, 14 provincial police agencies, 231 police stations, 2930 branch offices and other affiliated institutes including the National Police University, the Police Comprehensive Academy, the Central Police Training School, the Driver’s Licensing Agency and the National Police Hospital (KNPA, 2004). All police organizations work under one hierarchy (Figure 2). The total number of police officers is 92,165 (ibid.).

**Figure 2: Organizational Chart of KNPA**

Seoul: The Metropolis of Korea

Seoul is the capital of Korea and the centre of politics and business. It had a population of 10,276,968 as of the end of 2003 (Seoul Metropolitan Government, 2003), which accounted for about a quarter of the total national population. The total area of Seoul is 605.52 square kilometres, or 0.6 percent of the entire country (ibid.). The Han River bisects the city into two parts: the northern part (Gangbuk) and the southern section (Gangnam). The Gangbuk area totals 297.97 square kilometres (49.2%), while Gangnam is 307.55 square kilometres (50.8%) (ibid.).

Seoul’s share of Korean crime occurrence was 26% in 2000, 29% in 2001, 31% in 2002, and 29% in 2003 as recorded in police data. This accounted for approximately a quarter of the total national crime occurrence (ibid.). Table 1 shows the number of crime occurrences recorded in Korea from 2000 to 2003. Table 2 indicates the number of crime occurrences in Seoul.

Table 1: Number of Crime Occurrences in Korea 2000 - 2003

<table>
<thead>
<tr>
<th>Year</th>
<th>Murder</th>
<th>Robbery</th>
<th>Rape</th>
<th>Theft</th>
<th>Violence</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>941</td>
<td>5,461</td>
<td>6,855</td>
<td>173,876</td>
<td>333,630</td>
<td>520,763</td>
</tr>
<tr>
<td>2001</td>
<td>1,051</td>
<td>5,692</td>
<td>6,751</td>
<td>180,704</td>
<td>338,045</td>
<td>532,243</td>
</tr>
<tr>
<td>2002</td>
<td>957</td>
<td>5,906</td>
<td>6,119</td>
<td>175,457</td>
<td>283,930</td>
<td>475,369</td>
</tr>
<tr>
<td>2003</td>
<td>998</td>
<td>7,292</td>
<td>6,531</td>
<td>187,352</td>
<td>294,893</td>
<td>497,066</td>
</tr>
</tbody>
</table>

Table 2: Number of Crime Occurrences in Seoul 2000 - 2003

<table>
<thead>
<tr>
<th>Year</th>
<th>Murder</th>
<th>Robbery</th>
<th>Rape</th>
<th>Theft</th>
<th>Violence</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>167</td>
<td>1,400</td>
<td>1,522</td>
<td>36,030</td>
<td>96,936</td>
<td>136,055</td>
</tr>
<tr>
<td>2001</td>
<td>203</td>
<td>1,873</td>
<td>1,631</td>
<td>52,235</td>
<td>98,994</td>
<td>154,936</td>
</tr>
<tr>
<td>2002</td>
<td>169</td>
<td>2,137</td>
<td>1,482</td>
<td>61,709</td>
<td>81,834</td>
<td>147,331</td>
</tr>
<tr>
<td>2003</td>
<td>173</td>
<td>2,840</td>
<td>1,584</td>
<td>57,733</td>
<td>81,928</td>
<td>144,258</td>
</tr>
</tbody>
</table>


Seoul Metropolitan Police Agency (SMPA) polices Seoul. Seoul is broken down into 31 police precincts and the SMPA administers 31 Police Stations in Seoul. The entire police force of the SMPA is 40,000 officers. Approximately 1,200 police officers work in each police station.

It would be worth scrutinizing crime phenomena in Seoul. However, because of the large amount of work involved in analyzing the whole of the crime data for Seoul and the purpose of presenting measures which are more carefully tailored to a specific setting, only one of the police precincts of Seoul has been chosen. The “Gangnam Police Precinct,” which is policed by the Gangnam Police Station, was chosen for analysis. Figure 3 shows the whole map of Seoul and the red area indicates Gangnam Police Precinct.
Characteristics of The Gangnam Police Precinct

The Gangnam Police Precinct is located in south-eastern Seoul. It is 39.54 square kilometres. Its population is 372,701, which represents 3.6% of the population of Seoul. Approximately 5% of Seoul’s recorded crime occurred in the Gangnam Police Precinct each year from 2000 to 2003.

This area was chosen for analysis for the four following reasons:

(1) The Gangnam area is the economic and political centre of Seoul, and furthermore, the heart of Korea. A large portion of the city’s wealth and its power elite are located in this area and so crime in this area draws attention from the whole of Korea.
(2) The Gangnam Police Precinct is a complex region which is composed of residence and business zones. Therefore, analysis of the crime in this area should reveal how crime patterns vary according to the land-use or regional characteristics.

(3) Even though its population represents 3.6% of the population Seoul, its crime accounts for about 5% of the total number of recorded crime occurrences in Seoul. This means that the Gangnam Police Precinct is a crime clustered area in Seoul.

(4) The Gangnam area is a newly planned downtown district. Therefore, its map and network of roads are relatively clear, and thus suitable for spatial analysis by GIS.

Figure 4 is the detailed map of the Gangnam Police Precinct. In this map, the characteristics of this research area are indicated by symbols as follows.

① - Traffic conjunction point

② - Entertainment areas involving bars, taverns, or nightclubs

③ - Shopping center area

④ - Business area

⑤ - small house area

⑥ - Luxury apartment area
This area has a well-organized traffic system which is composed of systematic subway network and bus routes. In addition, there are many taxis and cars in this district. Traffic conjunction points (①) indicate the points where a bus stop and a subway station intersect. Around these points, shopping centers, entertainment zones, and business areas have been growing.
There are several famous Entertainment areas which consist of bars, taverns, restaurants, and nightclubs in this area. A number of young people come together to enjoy these establishments after their work. It is interesting to find that large and luxurious shopping centers are around traffic conjunction points. While open, these shopping centres are crowded with many people, which could make for a high-target situation for 'pickpockets.'

On both sides of major roads, business areas are present. During daytime, many people work in or around their offices, making these areas the most crowded ones. There are several clustered small house districts which are composed of 2 or 3 story buildings. These are middle-level residence areas. These are typically multi family homes.

There are also several Luxury apartment areas present in the precinct. Some of these apartments are located near the Han River because of the gorgeous view. Other luxury apartment areas are scattered throughout the district. The common characteristics of these apartments are that affluent people live there and the apartments typically have a good security system such as security guards and electronic alarms.
Chapter Four: Methodology and Hypothesis

Research Data Set

The KNPA has provided a data set for five common crimes - murder, robbery, rape, theft, and violence - ranging geographically from the Police Station to nationwide levels. These types of crimes can be divided into property and violent crime. The former involves theft and the latter includes murder, rape, and violence. Robbery has mixed characteristics of both violent and property crime. Violence is a peculiar type of crime in Korea. It includes an assault, a fight, and causing injury against a person but excludes rape and domestic violence. It is a comprehensive type of crime. Table 3 shows the status of crime occurrence in the Gangnam Police Precinct from 2000 to 2003.

These data include all reported crime, both completed and attempted. They contain a time of occurrence and an address for each crime occurrence. However, the number of murder and rape occurrences is too small to discover and to generalize their patterns. Thus, I will focus on the remaining three types of crime - robbery, theft, and violence.
Table 3: Number of Crime Occurrences in Gangnam Police Area 2000 - 2003

<table>
<thead>
<tr>
<th>Year</th>
<th>Murder</th>
<th>Robbery</th>
<th>Rape</th>
<th>Theft</th>
<th>Violence</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>3</td>
<td>146</td>
<td>76</td>
<td>2,654</td>
<td>4,894</td>
<td>7,773</td>
</tr>
<tr>
<td>2001</td>
<td>13</td>
<td>153</td>
<td>88</td>
<td>3,657</td>
<td>4,776</td>
<td>8,687</td>
</tr>
<tr>
<td>2002</td>
<td>4</td>
<td>252</td>
<td>76</td>
<td>3,745</td>
<td>3,788</td>
<td>7,865</td>
</tr>
<tr>
<td>2003</td>
<td>7</td>
<td>139</td>
<td>101</td>
<td>2,552</td>
<td>3,558</td>
<td>6,357</td>
</tr>
</tbody>
</table>


Hypothesis

As mentioned earlier, there exists abundant research on crime patterns in western societies. Such research has repeatedly supported the idea that there are patterns in crime. However, few studies have been implemented on the crimes that occur in eastern societies. Therefore, we could reasonably doubt that these patterns obtain in different societies, especially eastern societies. By analyzing the data set, I would like to confirm whether the crime patterns which have been discovered in western societies can be identified in Gangnam precinct in Seoul: one of the eastern societies.

As well, there has been an abundance of studies in the spatial analysis or crime patterns in comparison with a poverty of temporal analysis studies. A few researchers have tried to explore temporal patterns in crime, most of which represented a simple count of the number of crimes allowing only comparison from one period to the other or from one area to the other. Some of them have tried to identify the daily, weekly, or
monthly periodicity in the occurrence of criminal activities. In addition, there have been few attempts to link temporal analysis to spatial analysis. That is, temporal and spatial analyses have been executed separately. Only a few researchers have tried to explore temporal-spatial patterns of crime simultaneously. For example, Verma and Lodha (1999) made an attempt to connect temporal aspects to spatial analysis. They present a three-dimensional city map with two spatial dimensions and a time dimension that can be shown vertically (Verma & Lodha, 1999).

We cannot deny the fact that in analyzing crime patterns, exploring spatial patterns plays a crucial role. However, maps are only a part of the analysis and can not offer a complete picture of crime patterns (Clarke & Eck, 2003). By virtue of joining temporal and spatial analyses, we can get more comprehensive assessment of patterns in crime. Therefore, more emphasis should be placed on synchronous temporal-spatial analysis.

To sum up, my hypotheses are as follows:

1. There should be spatial-temporal patterns in crime evident in Seoul, Korea.
2. The observed spatial-temporal patterns should be stable over time.
3. There should be identifiable differences between the patterns in various kinds of crime.
4. The criminality of a place should be alleged for only some specific time period. This relates to the notion of “dynamic place” which means that the sense of a place is variable according to the flow of time.
As stated earlier, the studies in environmental criminology tend to follow analytic paths: objective analysis and subjective analysis. The above hypotheses are grounded on the former path - the objective analysis of the spatial and temporal variation in crime patterns - in order to discover aggregate factors influencing the patterns. Even though more emphasis will be placed on objective analysis, sometimes the ideas of subjective analyses will be employed to explain any found objective patterns in crime.

**Methodology in the Research**

To test the hypotheses, the data set is to be explored by spatial and temporal analysis. To explore spatial patterns in crime, the data set first will be mapped using GIS in order to permit a visual inspection of the data set. Then the data set will be tested against the complete spatial randomness (CSR) in order to determine statistically whether clustering is present rather than a random pattern.

In the temporal analysis, daily and weekly rhythm will be explored to discover any temporal patterns in crime. Finally, the spatial and temporal analyses will be merged using the idea of “dynamic place.”
Chapter Five: 
Temporal-Spatial Analysis

Spatial Analysis

Mapping and spatial statistics were used for the spatial analysis of this data set. For the purpose of mapping, this data set was edited and standardized for geocoding. Geocoding is a process where each criminal event is assigned X and Y coordinate values so it can be displayed as a point on a map (Insightful Corporation, 2000). The X and Y coordinate values become different depending on the adopted projection method. In this thesis, Universal Transverse Mercator (UTM) has been adopted and each crime datum had assigned UTM coordinate values. The cases that could not be geocoded have been excluded from further analyses. Once the address of each crime is edited and standardized for geocoding, the actual mapping is performed utilizing the ArcView GIS 3.3.

Except for robbery in 2002 and for violence in 2000, more than 78% of each crime type could be geocoded in each year. Table 4 is the summary of geocoding match rates for each crime from 2000 to 2003. Even though these match rates are not perfect, when considering the short history of systematic gathering of crime data in Korea, it is generally satisfactory. We can continue our spatial analysis without any significant problem.
Crime density is calculated by "Kernel estimation" which is a spatial statistical method that generates a map of density values from the point event data (Williamson, Mclafferty, and Goldsmith, 1995). Kernel smoothing creates a smooth map of density values in which the density at each location reflects the concentration of points in the surrounding area (ibid.). Different levels of concentration are shown by using different hue and intensity of colours. By virtue of this method, each year's density is categorized into nine grades having equal intervals. Figure 5 shows nine-level grades of density. To examine the extent of concentration vertically, three dimensional maps are to be created.

<table>
<thead>
<tr>
<th>Year</th>
<th>Match Score (Theft)</th>
<th>Match Score (Robbery)</th>
<th>Match Score (Violence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>2532/2654 (95.4 %)</td>
<td>119/146 (81.5 %)</td>
<td>3585/4894 (73.3 %)</td>
</tr>
<tr>
<td>2001</td>
<td>3657/3657 (100 %)</td>
<td>145/153 (94.7 %)</td>
<td>4494/4776 (94.1 %)</td>
</tr>
<tr>
<td>2002</td>
<td>2932/3745 (78.3 %)</td>
<td>146/252 (58 %)</td>
<td>3535/3788 (93.3 %)</td>
</tr>
<tr>
<td>2003</td>
<td>2021/2552 (79.2 %)</td>
<td>110/139 (79.2 %)</td>
<td>3168/3558 (89.0 %)</td>
</tr>
</tbody>
</table>
Finally, to strengthen the analysis of spatial concentration, spatial statistics has been adopted. Statistical methods are used to explain and strengthen the analysis of the spatial concentration. Typically, complete spatial randomness tests (CSR) are used to detect whether clustering is present in comparison with a random pattern. CSR verify whether the points are more clustered or dispersed than expected if crime were to occur randomly (Anselin et al., 2000: Insightful Corporation, 2000). The two tests for complete spatial randomness are $F_{\text{hat}}$ and $G_{\text{hat}}$, which were performed using the spatial statistics routines in S-Plus.

The $F_{\text{hat}}$ plot is an origin-to-point nearest neighbour statistic. In a $F_{\text{hat}}$ plot, if there is an excess of long distances, then it can be interpreted as clustering (Insightful Corporation, 2000). The $G_{\text{hat}}$ is the point-to-point distance method which looks at interactions between points on a small scale (ibid.). In the interpretation of the $G_{\text{hat}}$, clustering exists when there is an excess of short distance neighbors (Kaluzny et al., 1998). We can find that the interpretation of the $F_{\text{hat}}$ is the opposite of the $G_{\text{hat}}$.

Following figures (Figure 6 – 17) are $G_{\text{hat}}$ and $F_{\text{hat}}$ plots for robbery, theft, and violence in 2000 and 2002. The unit of distance is meter in these plots.
Figure 6: Ghat Plot of Theft 2000

Figure 7: Ghat Plot of Theft 2002

Figure 6 and 7 above show Ghat plots for theft in 2000 and 2002. As mentioned earlier, the excess of short distances between the points in the research area means that there is a possibility of clustering. These Ghat plots demonstrate a very high excess of short distances between points in the data. This suggests that this data is not random, and that there is clustering in the point data of theft.
Figure 8: Fhat Plot of Theft 2000

Figure 9: Fhat Plot of Theft 2002

Figure 8 and 9 above show Fhat plots for theft in 2000 and 2002. This statistic differs from the Ghat in that it determines whether clustering exists based on an origin-to-point statistic (Thompson, 2003). As stated earlier, the Fhat interpretation demonstrates clustering when there is an excess of large distances between point and the grid origin; dispersed data are represented by a shorter distance between the point and grid origin.
(ibid.). The results of Fhat (Figure 8, 9) above indicate that there is an apparent excess of larger distances from the grid origin to the points of the data, thus implying clustering of theft in this research area.

Figure 10:  Ghat Plot of Robbery 2000

Figure 11:  Ghat Plot of Robbery 2002

Figure 10 and 11 above show Ghat plots for robbery in 2000 and 2002. These Ghat plots demonstrate an excess of short distances between points in the data.
This suggests that this data is not random, and there is clustering in the point data of theft even though the clustering is somewhat weaker.

**Figure 12:** *Fhat Plot of Robbery 2000*

**Figure 13:** *Fhat Plot of Robbery 2002*

Figure 12 and 13 above show Fhat plots for robbery in 2000 and 2002. These Fhat plots indicate that there is an excess of larger distances from the grid origin to the points
of the data, thus implying clustering of robbery in this research area. Even though robbery has its spatial clustering pattern, we can confirm again that its clustering is not strong.

**Figure 14:** Ghat Plot of Violence 2000

![Ghat Plot of Violence 2000](image1)

**Figure 15:** Ghat Plot of Violence 2002

![Ghat Plot of Violence 2002](image2)
Figure 14 and 15 above show Ghat plots for violence in 2000 and 2002. The excess of short distances between the points in the research area means that there is a possibility of clustering. These Ghat plots demonstrate that this data is not random, and there is strong clustering in the point data of violence.

Figure 16: Fhat Plot of Violence 2000

Figure 17: Fhat Plot of Violence 2002
Figure 16 and 17 above show Fhat plots for violence in 2000 and 2002. As stated earlier, the Fhat interpretation demonstrates clustering when there is an excess of large distances between point and the grid origin; dispersed data are represented by shorter distance between the point and grid origin (ibid.). The results of Fhat imply clustering of violence in this research area.

In order to better grasp specific spatial patterns for each crime (Theft, Robbery, and Violence) point maps, two dimensional, and three dimensional maps for each crime will be shown as follows. Several 2D and 3D maps are presented in the text and other maps can be founded in the Appendices.

**Theft**

Theft is one of the most universal crimes in the property crime category. In order to understand crime patterns in a country well, therefore, it is so helpful to examine the pattern of theft. Theft is the taking of property or cash without personal contact. To get a correct understanding of the crime patterns in Korea, it is a prerequisite to be familiar with the notion and characteristics of theft. According to the Criminal Code of Korea, theft is defined as the act of a person who illegally takes property belonging to another with the intention of depriving the owner of it (Korean Government, 2003).

There is no significant difference in the notion of theft between Canada and Korea except that theft in Korea involves common theft out of a residence as well as breaking and entering theft. For example, according to the Canadian Criminal Code, incidents involving theft of property from within the sample household would only classify as theft if the offender has a legal right to be in the house (such as a maid or a guest). If the
offender has no legal right to be in the house, the incident would classify as break and enter. However, in Korea, the latter classifies as theft (i.e., breaking and entering theft) as well. The difference between burglary and theft is that the former is committed by trespass or illegal entry and the latter is not in Canada. In Korea no distinction is made and both kinds of acts are simply treated as theft.

Figures below (figure 18-25) are theft maps of the Gangnam Police Precinct from year 2000 to 2003. Figure 18 is the point map of theft in 2000. The other years' point maps can be found in the Appendices. Each coordinate value of a theft has been displayed as a point on the map. Concentrated points in an area constitute a hot spot (i.e., clustering area of crime). Figure 18-1 is the two dimensional map of theft (i.e., crime density map). The crime density map can show the distribution of values and areas of concentration more clearly. As stated earlier, different levels of concentration are shown by using different hue and intensity of colours. The darker, the more clustered. Figure 19 is the three dimensional map of theft. It shows the extent of concentration vertically. The higher, the more clustered.

**Figure 18:** Geocoded Points of Theft, 2000
Figure 18-1. Density Map of Theft, 2000

Figure 19: 3D Map of Theft, 2000
Figure 20: Density Map of Theft, 2001

Figure 21: 3D Map of Theft, 2001
Figure 22:  Density Map of Theft, 2002

Figure 23:  3D Map of Theft, 2002
Figure 24: Density Map of Theft, 2003

Figure 25: 3D Map of Theft, 2003
By examining the above maps, it is apparent that thefts are unevenly distributed in this area. Even though other smaller clusters have appeared and disappeared in each year, two major theft clustered districts (i.e., hot spots) are identified, which are stable from 2000 to 2003. Accordingly, it has been supported that there is an identifiable spatial pattern of theft in this research area. Figure 26 shows the two major hot spots of theft.

Figure 26: Hot spots of Theft

Hot spots I and II (Figure 26) are middle-level residence areas which are characterized by highly clustered small houses. It is amazing to find out that the characteristics of both areas are so similar. In Seoul, luxury high rise apartments are generally characterized by having high-quality security systems preventing outsiders from breaking into the apartments. By contrast, these two small housing neighbourhoods are characterized by easy accessibility when compared with a high apartment district.
The houses in this area are generally 2 or 3 story buildings and, in addition, they are short of private security guards or technical security systems. The houses are also very close to each other in this area. Thus, if a thief enters a house, he can move into another house nearby with little trouble. Furthermore, there are numerous and complicated alleys in this area which can help a thief run away easily after his theft and which obstruct the police in pursuing him.

According to routine activity theory, predatory crime occurs when a potential offender and suitable target come together in time and space, without a capable guardian (Cohen & Felson, 1979). By examining the characteristics of these places, one can be sure that these areas are full of suitable targets for thefts without a capable guardian.

It has been repeatedly supported that crime rates vary quite substantially by land-use type. For example, household thefts tend to be clustered near dense housing districts (Brantingham, 1996). This seems to be true in this area too.

Robbery

Robbery is generally rare in comparison with theft but can cause severe personal harm in addition to property loss and can generate high levels of fear (Brantingham, 1996). Therefore, it is commonly regarded as a significant crime. John Conklin (1972) states that robbery is a bell weather crime because of its far-reaching effects beyond the actual victims. Because of such reasons, the KNPA regard robbery as a key crime in Korea and pay careful attention to it.
Robbery is defined as the act or practice of taking something away from the person or presence of another by force or threat of force (Korean Government, 2003). The predominant difference between theft and robbery is that robbery involves violence or the possibility of violence to the victim. That is, robbery is a crime not only against a person but also against property which may result in patterns similar to those of property crime (ex., theft).

Under Korea's criminal code, robbery involves not only larceny from the person by force or threat of violence but also the act of entering a dwelling and taking variables away from the dweller by violence or threat. Robbery can occur on a street or in a dwelling when a person is present. Therefore, robbery involves residence robbery, street robbery, and shop robbery. The following figures (Figures 27 – 34) are the maps of robbery from 2000 to 2003 in the Gangnam police precinct.
Figure 27:  Density Map of Robbery, 2000

Figure 28:  3D Map of Robbery, 2000
Figure 29: Density Map of Robbery, 2001

Figure 30: 3D Map of Robbery, 2001
Figure 31: Density Map of Robbery, 2002

Figure 32: 3D Map of Robbery, 2002
Figure 33: Density Map of Robbery, 2003

Figure 34: 3D Map of Robbery, 2003
By examining the above maps, it is visually illustrated that robberies are disproportionately distributed in this police precinct. The robbery map for 2001 clearly shows one predominant hot spot. Even though the clusters are not as dominant as those of theft and other smaller clusters which appeared and disappeared in each year, two major clustered robbery districts which are stable over the time period analyzed are detected. Although we cannot deny the existence of an uneven concentration of crime, the regularity of hot spots in these maps seems to be weaker than that for theft. This may result from the small volume of robbery. Figure 35 shows the two major hot spots of Robbery.

**Figure 35: Hot spots of Robbery**
Hot spot I is the same place as the hot spot I of theft. This seems to result from the fact that both robbery and theft are property crimes which means that their crime targets and other conditions may be similar or sometimes the same. The other place (hot spot II) has some unique demo-geographic characteristics. Many single women live in small and unsafe houses in this district. According to the perspective of routine activity theory, crime occurs when a likely offender and suitable target come together in time and space, without a capable guardian present. Therefore, it can be assumed that these single women may be vulnerable targets that lack capable guardians and, therefore, attract robbers.

Violence

Violence is a peculiar type of crime in Korea. It includes an assault, a fight, and causing injury against a person but excludes rape and domestic violence. It is a comprehensive type of crime. Canada does not have a crime type similar to it. Violence is common and occurs frequently in Korea. At least half of the total quantity of the five common crimes in every year is violence. Citizens place a great deal of weight on violent crime.

It seems intuitively obvious that crimes resulting in physical injury to victims are worse and more reprehensible than those that produce only property losses. This perception has been confirmed by systematic surveys (see Reiss & Roth, 1993). For example, a fight may occur in a public entertainment area, and in or outside a bar so that it can be witnessed by the public, which should evoke the public's fear of crime.
It directly involves safety for the public. Violence seems to be a public safety barometer by which levels of crime are measured. The criminal justice system reflects these views. This is the reason why the KNPA regard it as one of the five common crimes.

The following figures (Figure 36 – 43) are maps of violence for the years 2000 to 2003 in the Gangnam police precinct.
Figure 36: Density Map of Violence, 2000

Figure 37: 3D Map of Violence, 2000
Figure 38: Density Map of Violence, 2001

Figure 39: 3D Map of Violence, 2001
Figure 40: Density Map of Violence, 2002

Figure 41: 3D Map of Violence, 2002
Figure 42: Density Map of Violence, 2003

Figure 43: 3D Map of Violence, 2003
The above maps demonstrate that violence is also clustered in some specific areas. Three dominant hot spots which are stable over time spots are identified. In comparing the maps of violence to those of theft and robbery, we find that there is a clear difference between them. This result can be explained by their different characteristics since theft and robbery are property crimes but violence is a crime against person. Figure 44 shows the three hot spots of violent crime.

Figure 44: Hot spots of Violence

There is a clear similarity in the above three hot spots I, II, and III (esp. between I and II). The common characteristic of the above hot spots I, II, and III, is that all of them are famous public entertainment zones which are crowded with a lot of bars and taverns along the streets. Various kinds of youth groups also gather in this area.
A large number of studies show that a significant portion of violent crime is linked to public entertainment (e.g., Porkorny, 1965; Ramsey, 1983; Roncek and Maier, 1991). A large portion of violence occurs in places of public entertainment. Violence often occurs on streets when people are on the way to or from places of public entertainment and, in addition, much public entertainment is not connected with specific locales but occurs in the streets where people gather (Wikstrom, 1995). It is argued that bars are criminogenic (Roncek & Pravatiner, 1989). Alcohol is a major ingredient in public entertainment and bars. Many violent crimes involve mutual fighters or offenders and victims at least one of whom is intoxicated.

There is no doubt that the results of the above studies in western societies can be applied to explaining violence concentration in the above three zones. Seeking drinking and entertainment, many young people crowd around these areas. Among them various problems and crimes can occur.
Temporal Analysis

Time is a key component that shapes human social activities and criminal events (Jenion, 2003). Biological necessity (eating and sleep) and social relationships (work or school) establish routines that are clearly identified in what we call time (ibid.). A temporal analysis can yield important trends in cycles and patterns of crime which can be useful for developing efficient crime policies. It has been repeatedly argued that crime has not only spatial patterns but also temporal patterns as well. For example, by analyzing Uniform Crime Report Data, Terance D. Miethe and Richard C. McCorkle (2001) found that robberies are less likely to occur in the spring. A large portion of street muggings happen during daytime hours, and the most popular days for robbery are Thursdays and Fridays (Desroches, 2002). It is intuitively clear that cycles of everyday activities have an influence on crime. For example, the ebb and flow of vehicles and people caused by commuting and shopping rhythms changes the number of targets and guardians in dwellings and parking facilities, which in turn influences when auto-thefts and break-ins are most frequent (Clarke & Eck, 2003).

Temporal research ranges from those exploring changes during short time periods to those exploring broad historic variations. That is, temporal analysis can involve multiyear, yearly, monthly, weekly, or even daily patterns (Brantingham & Brantingham, 1984). Not all levels of analysis will be equally beneficial to the research. It is then important to decide what level of analysis is best suited for this study. The time period should be fixed depending on the objective of the research. Longer time periods covering months and years are helpful in grasping the overall crime trend in a large area. However, short-term analysis over hours and days is more desirable for the purpose of detecting
crime rhythms which are influenced by the changes of targets, guardians, and other factors caused by cycles of routine daily activities. One of the main purposes in this research is to explore the changes of crime patterns according to the flow of time. Therefore, daily and weekly fluctuations are to be explored in this paper.

It is generally mentioned that the temporal data has severe limitations in precision in its occurrence measurements. Before analyzing temporal data, therefore, it is a prerequisite to confirm how they are collected and how exact they are. As mentioned earlier, this study relies on the crime data gathered by the KNPA. There are two general routes by which the KNPA records the occurrence time of crime. The first method is via a patrol officer detecting a crime occurrence by chance when patrolling the streets. In this case, the exact occurrence time of the crime can be recorded since the patrol officer can see the occurrence of the crime in person. The second method is via citizens, such as the victim, passers-by, or witnesses reporting the crime to the KNPA over the 112 emergency police calling lines. The police, then, estimate the occurrence time of the crime by the testimony of the reporters, victims, or witnesses. Generally, most information of crime occurrences is gathered by the latter method. In this case, exact times are not known. However, it should be pointed out that the KNPA does not record the time the incident was phoned in by a reporter as an occurrence time, instead, the police estimate the occurrence time as exactly as they can, based on the testimony.

In the case of violence, most of the violent crimes are reported to the police by the people who are engaged in the crime or a witness who may have seen the crime occur. Therefore, there is not a significant gap between the real and estimate occurrence time of
violence. However, in the cases of theft (especially, the break and entering type), a disparity may exist between the actual and estimated occurrence time since the victim may not know the exact occurrence time if he or she was not at home or was sleeping when the criminals broke in. For example, when a residence is left unoccupied during the daytime, a thief could break into the house and the resident would not discover the crime until returning home. This theft may be estimated at a certain point during the unoccupied time range. Therefore, one cannot deny that the occurrence time of theft and robbery has limitations in precision. However, the data are more precise than thought since the KNPA has developed a good methodology to estimate the occurrence time. In order to estimate the occurrence time of the crime, the KNPA investigate neighbours or possible witnesses and check all possible clues. In addition, there are not many cases of theft and robbery where it is hard to estimate their occurrence time. As well, we do not have any other temporal data which is more precise and consistent than that of the KNPA. Accordingly, we can go ahead in this analysis without significant anxiety.

One of the popular analyzing techniques in temporal analysis is charting because charting the rhythm of crime helps identify temporal patterns in crime. Through this method, we can identify the daily and weekly periodicity in the occurrence of criminal activities. Jerry Ratcliffe (2002) has identified three forms of temporal patterns: (1) “Diffused pattern” which means that events are relatively evenly spread over the entire day, (2) “Focused pattern” which shows clustering within distinct time ranges, and (3) “Acute patterns” which are tightly packed within short periods. Even though he developed the above typology only for daily patterns, the basic idea can be applied to weekly patterns as well (Clarke & Eck, 2003).
Table 5 and chart 1 show temporal patterns of theft from 2000 to 2003 in the research area.

**Table 5: Daily Pattern of Theft**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Late Night</th>
<th>Morning</th>
<th>Afternoon</th>
<th>Evening</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000</td>
<td>2654(100%)</td>
<td>834(31%)</td>
<td>434(16%)</td>
<td>593(23%)</td>
</tr>
<tr>
<td></td>
<td>2001</td>
<td>3656(100%)</td>
<td>1180(32%)</td>
<td>549(15%)</td>
<td>829(23%)</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>3745(100%)</td>
<td>1051(28%)</td>
<td>554(15%)</td>
<td>1018(27%)</td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>2552(100%)</td>
<td>743(29%)</td>
<td>359(14%)</td>
<td>718(28%)</td>
</tr>
</tbody>
</table>

**Chart 1: Daily Pattern of Theft**

By examining Chart 1, it is clear that there is a similar temporal pattern in theft over the time periods analyzed; this can be characterized as "a focused pattern" according to Ratcliffe's typology since it shows clustering within distinct time ranges. As mentioned earlier, "burning time" means the cluster of crime in temporal dimension. Two
burning times such as late night and evening, are confirmed. Approximately 60% of theft occurs in the evening and late night periods.

Table 6: Weekly Pattern of Theft

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>2654</td>
<td>300</td>
<td>370</td>
<td>378</td>
<td>426</td>
<td>401</td>
<td>371</td>
<td>408</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>11%</td>
<td>14%</td>
<td>14%</td>
<td>17%</td>
<td>15%</td>
<td>14%</td>
<td>15%</td>
</tr>
<tr>
<td>2001</td>
<td>3656</td>
<td>365</td>
<td>439</td>
<td>578</td>
<td>568</td>
<td>562</td>
<td>569</td>
<td>575</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>10%</td>
<td>12%</td>
<td>16%</td>
<td>15.5%</td>
<td>15%</td>
<td>15.5%</td>
<td>16%</td>
</tr>
<tr>
<td>2002</td>
<td>3745</td>
<td>400</td>
<td>500</td>
<td>531</td>
<td>594</td>
<td>555</td>
<td>564</td>
<td>601</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>11%</td>
<td>13%</td>
<td>14%</td>
<td>16%</td>
<td>15%</td>
<td>15%</td>
<td>16%</td>
</tr>
<tr>
<td>2003</td>
<td>2552</td>
<td>308</td>
<td>353</td>
<td>342</td>
<td>376</td>
<td>364</td>
<td>435</td>
<td>374</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>12%</td>
<td>14%</td>
<td>13%</td>
<td>15%</td>
<td>14%</td>
<td>17%</td>
<td>15%</td>
</tr>
</tbody>
</table>

Chart 2: Weekly Pattern of Theft

By observing Chart 2, it is apparent that thefts are relatively evenly spread over the entire week. Such a temporal pattern can be classified as "a diffused pattern." This
diffused pattern was stable from 2000 to 2003. In spite of weekends, thefts do not
decrease, but we can find a little reduction on Sunday.

### Table 7: Daily Pattern of Robbery

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Late Night 00:00-07:00</th>
<th>Morning 07:00-12:00</th>
<th>Afternoon 12:00-18:00</th>
<th>Evening 18:00-24:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>146(100%)</td>
<td>82(56%)</td>
<td>19(13%)</td>
<td>20(14%)</td>
<td>25(17%)</td>
</tr>
<tr>
<td>2001</td>
<td>153(100%)</td>
<td>86(56%)</td>
<td>11(07%)</td>
<td>26(17%)</td>
<td>30(20%)</td>
</tr>
<tr>
<td>2002</td>
<td>252(100%)</td>
<td>175(69%)</td>
<td>15(06%)</td>
<td>27(11%)</td>
<td>35(14%)</td>
</tr>
<tr>
<td>2003</td>
<td>139(100%)</td>
<td>75(54%)</td>
<td>29(21%)</td>
<td>13(09%)</td>
<td>22(16%)</td>
</tr>
</tbody>
</table>

### Chart 3: Daily Pattern of Robbery

Chart 3 shows us that there is a predominant burning time of robbery. Robberies
are tightly packed in the late night period. Such a temporal pattern can be termed as an
“acute pattern” according to Raticliffe’s terminology. There is a clear difference in the temporal patterns between robbery and theft.

**Table 8: Weekly Pattern of Robbery**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>146</td>
<td>15</td>
<td>19</td>
<td>24</td>
<td>19</td>
<td>29</td>
<td>19</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>10%</td>
<td>13%</td>
<td>16%</td>
<td>13%</td>
<td>20%</td>
<td>13%</td>
<td>15%</td>
</tr>
<tr>
<td>2001</td>
<td>153</td>
<td>12</td>
<td>12</td>
<td>25</td>
<td>29</td>
<td>30</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>8%</td>
<td>8%</td>
<td>16%</td>
<td>19%</td>
<td>20%</td>
<td>15%</td>
<td>14%</td>
</tr>
<tr>
<td>2002</td>
<td>252</td>
<td>30</td>
<td>15</td>
<td>36</td>
<td>40</td>
<td>49</td>
<td>39</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>12%</td>
<td>6%</td>
<td>14%</td>
<td>16%</td>
<td>20%</td>
<td>15%</td>
<td>17%</td>
</tr>
<tr>
<td>2003</td>
<td>139</td>
<td>12</td>
<td>13</td>
<td>32</td>
<td>19</td>
<td>30</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>9%</td>
<td>9%</td>
<td>23%</td>
<td>14%</td>
<td>21%</td>
<td>13%</td>
<td>11%</td>
</tr>
</tbody>
</table>

**Chart 4: Weekly Pattern of Robbery**

Chart 4 shows a focused pattern where crime clusters within distinct time ranges.

It also represents a stable temporal pattern over time. In the case of robbery, Tuesday and
Thursday are relatively high burning times. The occurrence of robbery decreases on Sunday and Monday. This pattern is different from that of theft.

Table 9: Daily Pattern of Violence

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Late Night 00:00–07:00</th>
<th>Morning 07:00–12:00</th>
<th>Afternoon 12:00–18:00</th>
<th>Evening 18:00–24:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>4894(100%)</td>
<td>2508(51%)</td>
<td>392(08%)</td>
<td>623(13%)</td>
<td>1371(28%)</td>
</tr>
<tr>
<td>2001</td>
<td>4776(100%)</td>
<td>2511(53%)</td>
<td>404(08%)</td>
<td>548(11%)</td>
<td>1313(28%)</td>
</tr>
<tr>
<td>2002</td>
<td>3788(100%)</td>
<td>1873(49%)</td>
<td>430(11%)</td>
<td>487(13%)</td>
<td>998(27%)</td>
</tr>
<tr>
<td>2003</td>
<td>3558(100%)</td>
<td>1646(46%)</td>
<td>443(12%)</td>
<td>532(15%)</td>
<td>937(27%)</td>
</tr>
</tbody>
</table>

Chart 5: Daily Pattern of Violence

Violence has its unique temporal pattern and it is stable over time. Chart 5 represents “an acute pattern” since events are tightly packed within the late night period.
No particular day of the week is routinely troublesome for violence, which indicates a diffused weekly pattern. Even though there is a weak reduction of violence on Sunday and Monday, violence generally occurs evenly over the week. This finding
refutes the expectation that a focused pattern of violence during Fridays and Saturdays would be found.

**Linking Spatial Analysis to Temporal Analysis: Dynamic Place**

As mentioned earlier, “place” is not static but rather it is dynamic and varies according to the flow of time. Accordingly, to get more specific information on the criminality of a place, temporal aspects of the crime pattern should be explored. That is, space and time must be considered simultaneously to get a correct understanding of crime patterns in a certain place; this results in obtaining a more comprehensive picture of the patterns in crime.

To connect temporal to spatial analysis, the whole day (i.e., 24 hours) was broken into four time periods – late night (00:00-07:00), morning (07:00-12:00), afternoon (12:00-18:00), and evening (18:00-24:00). Then, the geocoded data set was allocated into each time period according to its occurrence time. This process has been developed to reflect the idea that the characteristics of a place vary according to the flow of time.

Crime data of theft and violence in 2003 have been selected for this synthetic analysis. The analysis of robbery has been omitted because of an insufficient number of occurrences. Figure 46 shows four maps of theft in each time period.
Figure 45: Hot spots of Theft

Figure 46: Maps of Theft in different time periods

<table>
<thead>
<tr>
<th>Theft in the morning</th>
<th>Theft in the afternoon</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.jpg" alt="Map of Theft in the morning" /></td>
<td><img src="image2.jpg" alt="Map of Theft in the afternoon" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Theft in the evening</th>
<th>Theft in the late night</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.jpg" alt="Map of Theft in the evening" /></td>
<td><img src="image4.jpg" alt="Map of Theft in the late night" /></td>
</tr>
</tbody>
</table>
By comparing Figure 45 with 46, we can confirm that hot spots I and II of Figure 16 are not always crime-clustered areas during the whole day. Significantly, in the afternoon (12:00 – 18:00), completely different districts are identified as hot spots for theft. These hot spots in the afternoon are major shopping centre areas. Under the Korean criminal code, as stated earlier, pocket-picking classifies as a theft (a theft on the street). In these shopping centre areas there are many people shopping in the afternoon which means many potential vulnerable targets are available to pickpockets and, in addition, these crowded people can function as a veil to hide theft. After offending, thieves can disappear into the crowd of shoppers. Instead, those hot spots I and II of Figure 45 are crowded with people during day time that may play a role as a guardian.

In the temporal analysis, theft has been identified as having focused patterns which shows clustering in the evening and late night. Though there is a slight difference between them, theft maps of evening and late night have hot spots similar to those of Figure 16. Especially, hot spots in late nights are the same as those of Figure 16.

Figure 47 shows hot spots of violence and Figure 48 below shows the maps of violence in different time periods.
Figure 47:  Hot spots of Violence

Figure 48:  Maps of Violence in different time periods

<table>
<thead>
<tr>
<th>Violence in the morning</th>
<th>Violence in the afternoon</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Map of Violence in the morning" /></td>
<td><img src="image2" alt="Map of Violence in the afternoon" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Violence in the evening</th>
<th>Violence in the late night</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Map of Violence in the evening" /></td>
<td><img src="image4" alt="Map of Violence in the late night" /></td>
</tr>
</tbody>
</table>
By contrasting figure 47 with 48, it becomes clear that hot spots I, II, and III of Figure 47 are not always crime-clustered areas during the whole day. Especially, in the afternoon (12:00 – 18:00) and evening (18:00 – 24:00), completely different districts are violence-clustered areas. The hotspots in the afternoon map are business areas where many people work in their offices. Many people are there for their jobs and businesses and during their activities there can be troubles, fights, and assaults between them. In the evening most of the people who worked at their offices would leave their offices, some will go their home and others go to taverns and bars in the entertainment area in order to relax. However, others may work late to finish their intended work for the day and it is common to work in the evening after finishing time in Korea. Therefore, when looking at the violence map in the evening, one can find that business areas and entertainment areas are somewhat clustered with violent crimes. When looking at the above maps, violent crimes vary according to the flow of people. In the case of violence, people are potential offenders and victims. Violent crimes are emotional crimes and crime against people. Sometimes, common people can fight against others and they can be victims of violent people. Accordingly, one can argue that hot spots of violence parallel the flow of people.

In the temporal analysis, violence was verified as having an acute pattern since violence crimes were tightly packed within the late night period. Only the map of late night illustrates the same crime hot spots as those of Figure 47.

To sum up, theft-clustered zones were hot only during its burning time and violence-concentrated areas were hot only during the late night period: “it’s burning time” as well. Accordingly, we can say that hot spots go together with “burning” times.
Chapter Six: Conclusion

Recap of Analyses and Results

By the results of the analyses, my hypotheses have been fully verified. In detail,

1. There are spatial-temporal patterns in crime in Seoul, Korea.

2. The observed spatial-temporal patterns are stable over time.

Examining the above maps visually carries the conviction to us that there are spatial-temporal patterns in crime in the research area: an eastern city. By observing the patterns in each crime from 2000 to 2003, it has been verified that such patterns are consistent over the observed time. Therefore, the above hypotheses have been verified.

3. There should be an identifiable difference between the patterns in various kinds of crime.

By comparing hot spots and burning times of each crime, it has been clearly demonstrated that each crime has its own unique temporal-spatial pattern different from other crimes. Through spatial analyses, it has been confirmed that theft and robbery share similar spatial patterns but violent crime has a spatial pattern which is distinguished from those of the former. In addition, we could detect differences in each crime's temporal pattern.
4. The criminality of a place should be alleged for only some specific time period.

By categorizing each crime into four time periods in a day, four different maps could be obtained for each period. And, through examining these maps, it has been verified that crime hot spots vary according to the flow of time. Therefore, it has been supported that criminogenic spots are hot only during definite times. That is, hot spots go together with burning times.

Policy Implications

When a doctor begins to cure a patient of a disease, he or she generally goes through three steps. First, the patient’s symptoms are examined in order to establish the disease. As a second stage, by virtue of the information gathered by this observation, the root causes of the symptoms are identified. As a final step, the doctor prescribes an appropriate medicine and treatment to the patient based upon the diagnosis. For successful treatment, therefore, it is a prerequisite to observe a patient’s symptoms and identify the root causes of a disease.

Crime can be paralleled to a disease, one of a society, rather than an individual. Therefore, if one tries to treat the illness of a society: crime, the first priority should be to examine the phenomena of crime in the society. By identifying the patterns and trends in crime, we can establish the root causes which generate crime and then develop crime control methods tailored to the society. Crime control polices without such cautious diagnosis would result in failure.
In the field of crime prevention policy, over the past years, there have been numerous failures worldwide because analysis of the crime problem was not executed before developing and enforcing crime prevention measures. For example, some conventional measures have relied heavily on the use of enforcement and simple responses to crimes which have occurred without any effort to investigate the symptoms and root causes of crime. These conventional policies operate much like a factory production line making a standard product rather than like a professional service that tailors its product to the particular needs of clients (Clarke & Eck, 2003).

In addition, the policies which have succeeded in one specific area have been introduced to other regions without regard to the specific crime patterns and characteristics of the region and, accordingly, failed as well. For example, measures to disrupt prostitution in Vancouver resulted largely in displacement of the problem because, unlike the case in a London suburb where similar measures had been successful, the prostitutes involved were highly dependent on their earnings to support drug habits or for other reasons (Clarke, 1995).

The above examples lead one to realize how important it is to analyze the crime phenomena and to detect the unique natures of crime in a specific area for the purpose of developing efficient and appropriate crime control policies. That is, the more detailed information on crime patterns we can get, the more efficient countermeasures can be developed. In this thesis, temporal-spatial analysis has been suggested as one method by which we can gain a more concise idea of crime patterns.
This general principle was applied in the policing field by Herman Goldstein. He originated the concept of problem-oriented policing in a paper published in 1979 (Clarke & Eck, 2003). His idea was that policing should fundamentally be about changing the root causes that give rise to recurring crime problems, and should not simply be about responding to incidents as they occur or forestalling them through preventative patrols (ibid.). Goldstein (1990) said the police must adopt a problem-solving approach in which they work through the following four stages: Scanning, Analysis, Response, and Assessment. Furthermore, the first priority was put on the step of analysis. Identifying crime patterns is a key factor for proactive policing and crime prevention strategies. It is fair and proper since success and failure of a counter-crime program definitely relies on how well we understand crime patterns in an area. For the purpose of investigating and identifying patterns and trends in crime, the problem-oriented approach heavily relies on the analytic skills and achievements of environmental criminology. Thus, POP and an environmental approach can go together well. Grounded on the same principle, Clarke and Eck (2003) suggest twenty-five techniques of situational crime prevention, such as hardening or removing the target of the offence, reducing the rewards of the crime, and extending guardianship.

In this research, one could identify more comprehensive patterns in crime by merging spatial and temporal analysis. By linking spatial and temporal analysis, we can get more comprehensive patterns in crime which enables us to develop more efficient crime control measures. In order to illustrate the advantages of this synthetic analysis, let us look at violent crime as an example. As mentioned earlier, the criminogenic place is
only hot during the burning times. In the case of violence, the identified hot spots I, II, and III are criminogenic only in the late night. Furthermore, we could infer that alcohol and the clustering of people (i.e., targets of crime) can be the root causes for such crime concentration. By virtue of this analysis, the police in the Gangnam precinct can address this crime problem by the techniques of increasing official guardianship. In detail, we already know where and when violence clusters. Therefore, one can allocate patrol officers at the expected hot spots during late night, rather than the whole day. Even though the Gangnam police station does not have enough patrol officers, the police force can be allocated only where and when it is necessary because of the knowledge of the temporal-spatial patterns in violent crime. By contrast, only by spatial analysis can it be identified where violence clusters are and the Gangnam police station should allocate patrol officers at identified hot spots during the whole day.

Another method to strengthen surveillance is to increase street lights and CCTV at the identified hot spot areas. These tools could constrain potential offenders. Of course, in this case as well, we do not need to monitor the CCTV the whole day; instead, only during the burning time (i.e., in the late night), therefore saving money.

This simple example shows us how beneficial it is to get more comprehensive and detailed crime patterns in addressing the crime problem.
Directions in Future Research

Until now, I have argued how important and beneficial it is to get more comprehensive patterns in crime in order to address the crime problem properly. For this purpose, however, it is a prerequisite to get exact and detailed crime data. Furthermore, to identify the root causes of such crime patterns, other data should be analyzed.

Data Gathering Stage

As mentioned, I have analyzed crime data in Seoul developed by the KNPA. However, there are several drawbacks in the data gathering system of the KNPA. First, this data set is not crime specific. In detail, in the case of robbery, under the umbrella of Korean criminal code, robbery involves street robbery, commercial robbery, and residential robbery, all of which are classified as robbery. However, it is clear that there is a significant difference in the methods and patterns between street, commercial, and residential robbery. Therefore, robbery should be broken down into commercial, street, residential robbery and data based on each type of robbery must be developed.

This is also true in the case of theft. Accordingly, theft should also be broken down into three sub categories such as street theft (i.e. pickpocket), commercial, and residential theft.

In case of violence, assault, injury, and fighting are included. Again, one cannot deny that there is a clear difference in the methods and conditions between these types of violence. Therefore, data for violence also should be gathered on each type of violence.

The other problem with the KNPA’s data set is that it only has the time and place of crime occurrence. It does not have any information on where the known offenders live.
In addition, there is no data about victims of each crime. Therefore, in future, the information on offenders and victims must be included in the KNPA data set.

**Combination of Other Data and Analyses**

It was confirmed that one can get more concise patterns in crime when merging temporal and spatial analysis. Furthermore, we can infer that if we combine other data sets and analyses with this temporal-spatial analysis, we will, then, understand crime patterns better. For example, a more comprehensive demo-geographic database can be developed, and field-work, then, can be undertaken to examine more closely the built nature of this research area. In addition, qualitative research methods can be added. For example, interviews with the police officers who have worked for a long time in the research precinct would be helpful to establish the root causes generating such crime patterns.

**Constructing a Comprehensive Data Set of Crime Patterns**

In this research, I employed the data set of only one police precinct in Seoul from 2000 to 2003 because of the limitation of time and data availability. Therefore, this may have limitations in its scope and generalization. I propose to the KNPA that it should have a steady and comprehensive database on crime patterns in all of Korea. If the spatial-temporal crime patterns of the whole of Seoul, and, furthermore, of the whole of Korea can be identified, it would yield very useful results. Grounded on the temporal-spatial patterns of the whole of Korea, one can reallocate the police force according to the actual needs of the police force. Further, by virtue of the crime patterns of each police precinct, we could develop and execute efficient crime prevention programs tailored to
each specific police precinct. If we can store crime data sets for a long time, then we can get more exact crime patterns in the future, which will ultimately elevate the ability of the KNPA to control crime.

Exchange of Ideas and Findings between Western and Oriental Criminology

As stated, I chose the crime data of the Gangnam police precinct in Seoul, Korea in order to confirm whether the findings and theories of criminological research in western societies can hold for Asian countries. The results of my analysis verify that there is a sufficient similarity in crime patterns between western and oriental societies. This means that Asian criminology can use the ideas and findings of western criminology.

My research was only on Seoul, Korea. In future, if any analysis were to be conducted on other Asian cities such as Tokyo, Japan and Beijing, China, it will contribute to the generalization and development of criminology. Furthermore, if new ideas and findings of oriental societies could be introduced to western criminology, it will accelerate the realization of “the safe society” in the world.
References


Appendices

Point map of Theft, 2000

Point map of Robbery, 2000
Point map of violence, 2000

Point map of Theft, 2001
Point map of Robbery, 2001

Point map of Violence, 2001
Point map of Theft, 2002

Point map of Robbery, 2002
Point map of Violence, 2002

Point map of Theft, 2003
Point map of Robbery, 2003

Point map of Violence, 2003