SPATIAL-STATISTICAL ANALYSIS
OF ARSON ACTIVITY
IN THE GREATER VANCOUVER REGION
OF BRITISH COLUMBIA

by

Andrea Suzanne Curman
B.A. Psychology and Family Studies, University of British Columbia

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APPROVAL

Name: Andrea Suzanne Curman

Degree: Master of Arts

Title of Thesis: Spatial-Statistical Analysis of Arson Activity in the Greater Vancouver Region of British Columbia

Examining Committee:

Chair: Brian Burtch
Professor of Criminology, Simon Fraser University

Paul J. Brantingham
Senior Supervisor
Professor of Criminology, Simon Fraser University

Patricia L. Brantingham
Supervisor
Professor of Criminology, Simon Fraser University

Gail S. Anderson
Supervisor
Associate Professor of Criminology, Simon Fraser University

Rtd. Deputy Chief Gary Greer
External Examiner
Vancouver Police Department

Date Approved: July 19, 2004
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Research in the area of Environmental Criminology has substantiated that the spatial and temporal nature of crime occurrence is neither random nor uniform; rather, it exhibits reliable patterns across crime types to the extent that such patterns are predictable. Spatial analysis research on the crime of arson is limited and such studies from a Canadian context are virtually non-existent. The study's objective was to provide a comparative spatial-statistical analysis of arson target selection patterns between single time and serial arsonists across various jurisdictions in the Greater Vancouver Region of British Columbia. The sample consisted of arson cases cleared with a charge laid to the offender; 46 single time arsonists charged with 32 arsons and 7 serial arsonists charged with 69 arsons. Data were obtained via two police databases, PIRS from the RCMP and PRIME from the VPD as well as through case files of serial arsonists. The arsonist's residential locations at the time of the charge and concomitant arson locations were documented and the distance between was measured for a comparative spatial-statistical analysis. The average distance traveled from home to crime scene for the arsonists in total was 2.17 km. The results showed that the single time arsonists traveled further on average to select targets (3.38 km) than the serial arsonists.
(1.49 km). The difference in the distance traveled to crime scene between the two samples was statistically significant ($p < .001$). The study revealed a specific geographical range of target selection favored by arsonists within which the majority of arsons were committed, approximately 0.25 km to 2 km from their residence. The results lend credence to the salience of well-documented phenomena of the awareness space and buffer zone within the spatial target selection patterns of both single and serial arsonists. Inferences towards the utility of the findings for Law Enforcement Investigation of serial arson are suggested as well as future research trajectories in the area of spatial analysis and the crime of arson.
DEDICATION

To my mother, Suzanne Nemeth in honour of her successful struggle with cancer: the ultimate example of fortitude. And to my father, Michael Nemeth who always foresees my capabilities before I do: the ultimate example of faith.

This thesis is dedicated to you both.
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CHAPTER ONE: THEORETICAL BACKGROUND

Introduction

The field of Criminology has evolved from asking the question, 'why criminals behave the way they do' to 'where and when does criminal behavior take place'. Within that shift, the field of Environmental Criminology is dedicated to answering the latter and in doing so amalgamates spatial, temporal and social ecological analyses. In this domain, there lie at least two essential tenets a researcher must assume. The first is that there exist criminally motivated persons who rationally decide to engage in delinquent activity (Brantingham and Brantingham, 1984; Clarke and Cornish, 2001). The second is that criminals do not exist in a vacuum, rather, for the majority, function as non-criminals and thus exhibit patterned behaviors (Brantingham and Brantingham, 1984). In general, the 'criminal equation' is comprised of the law, which definitively, must be broken, the crime site location, the offender and the victim. The field of Environmental Criminology dedicates itself principally to one aspect of the above equation, the location, or more generally, the criminal event.

Research conducted from an Environmental Criminology perspective has substantiated that the spatial and temporal nature of crime occurrence is neither random nor uniform; rather exhibits reliable patterns across crime types to the extent that such patterns are predictable. Amongst this research, the crime type
of arson is largely unstudied. According to the Canadian Criminal Code, the crime of arson is a federally indictable offense in which a person "intentionally or recklessly causes damage by fire or explosion to property" (Criminal Code of Canada, December 31, 2002). The criminal target selection pattern of arsonists has been assessed mostly in the United Kingdom (Canter and Fritzon, 1998; Fritzon, 2001) and not in Canada. Thus, in conjunction with the 'E' Division, Major Crimes Unit of the RCMP, the crime of arson was selected as an area in need of research with regard to the geographical aspects of arson target selection processes.

The objective of this study was to explore the spatial attribute of distance traveled to crime scene within the target selection process of arsonists in the Greater Vancouver Region of British Columbia, Canada. It is the argument of this study that the concepts integral to the explication of the criminal event from an Environmental Criminology standpoint are of great utility in assessing the spatial patterns of arsonists within the target selection process. It is essential, though, to begin by discussing the theoretical foundations within Environmental Criminology in order to illustrate how such concepts may be applied to discerning the spatial activity patterns of arsonists. The study will commence with a review of the fundamental theoretical perspectives that collectively represent the field of Environmental Criminology: the work of the Brantinghams in crime site selection; Social Ecology and Routine Activities Theory; Rational Choice Theory; and, finally, Pattern Theory.
Crime Site Selection

To clarify the use of the term 'theory', the following definition is adopted for this paper: a systematic collection of concepts and relations that function to explain and predict certain phenomena (Klein and White, 1996). Within that definition, Brantingham and Brantingham (1978b, 1981, 1984, 1993a; 1993b) have contributed significantly to the field of Environmental Criminology in providing numerous frameworks and testable propositions with concepts relating to their assessment that criminal behavior is not random in nature. At a micro level of analysis, Brantingham and Brantingham (1978b, 1984) describe how a criminal, as an individual, engages in target selection. In their theory of Crime Site Selection, Brantingham and Brantingham expound upon several propositions to explain that crime site selection is complex, yet patterned. It is held that the commission of an offense is the end result of a rational process reflecting a choice on the part of the offender to proceed with illegal activity. This decision process can be summarized within six propositions.

The first proposition reiterates that the commission of an offense is the end result of a multi-staged decision making process wherein the offender's cognition and the features of his environment interact bi-directionally with the end result being the selection of a target. It is explained that the beginnings of the target selection process may exhibit 'mixed scanning' (Brantingham and Brantingham, 1978b) where the criminal engages in a general scan of a geographic area where he or she feels most familiar and comfortable and continues to narrow the scope of the search. Next to be considered involves
areas where attractive targets are located within that part of the city and then a further narrowing to a street or neighborhood towards the identification of a specific target; does it have an easy entry and/or exit route; does the area allow for anonymity; does the reward of the criminal act outweigh the risk of being caught based on the target chosen? Brantingham and Brantingham (1984) assert that this process is neither conscious nor constant in nature; they argue that this search process may often occur unconsciously and change as criminals move and/or experience different life events that may alter their perceptions of what constitutes a desirable target.

Secondly, it is stated that all geographic areas and targets are not created equal, as they possess differential cue-emitting potential (Brantingham and Brantingham 1984). The extent to which a criminal defines a certain environment as embodying target cues is a function of their background. For example, if a criminal has spent a large proportion of time in an urban area, he or she would be familiar with the spatial structures and the tempo of city life. Thus, they may be more likely to view a downtown city centre as a suitable environment from which to choose a target. The level of exposure a criminal has to certain environments may determine how many cues are identified within it. Third, once the area is chosen, a criminal may be attracted to specific targets based on previous criminal experiences or exposure to his or her surroundings during routine non-criminal activity. This is termed 'crime cues'. Such attributes are likely to be favoured by the criminal due to their familiarity or association with the successful commission of previous crimes.
The fourth proposition asserts that criminals, through experience and varying backgrounds, establish a crime template; a pervasive idea of what area, person or establishment is attractive to target, what time of day is best for criminal activity to take place and the sequence of events underlying the commission of the crime (Brantingham and Brantingham, 1984). A ‘good’ target may reflect something in the offender’s past and present perceptual environment that emits crime cues. For example, the criminal may deem a target as desirable if it embodies the characteristics of previous targets of successful criminal activity. Based on the formulated crime template, the criminal may filter the details of each situation and target, deciding if it is advantageous in maximizing rewards while ensuring the avoidance of detection. A crime template may be viewed as being similar to a cognitive script, which the criminal can follow in illegal pursuits. If the commission of the crime is successful, the crime template will be reinforced cognitively. The specific attributes of a crime template (i.e., what defines ‘attractiveness’ or ‘ideal setting’ for each offender) are arguably as diverse as criminals are themselves. Yet, Brantingham and Brantingham (1981) hold that:

Because of the multiplicity of targets and victims, many potential crime selection templates could be constructed. But because the spatial and temporal distribution of offenders, targets, and victims is not regular, but clustered or patterned, and because human environmental perception has some universal properties, individual templates have similarities, which can be identified. (p. 29)
Thus, what constitutes target attractiveness in the development of the crime template may vary with each individual offender; however, it is the influence of the environment on the cognition of the offender and the offender's subsequent perception of that environment that Brantingham and Brantingham (1984) hold as a predictable pattern in the process of crime site selection. For example, the lifestyle of the offender will affect the eventual identification of a suitable crime site area. If one takes transit, one will be aware of areas surrounding transit stations, if one drives one will be familiar with the main travel arteries of the city, if one works inside of the home one may be familiar with a much smaller area and establishments than a potential offender whose lifestyle requires greater mobility (see Cromwell, Olson and Avery, 1991).

Within this process, Brantingham and Brantingham (1984) hold that certain aspects of the crime template are predictable in nature, yielding patterns across offenders and crime types. This concept stems from patterns exhibited by non-criminals in which people recognize situations and circumstances similarly; patrons at a football game understand that different mannerisms are acceptable at that venue than are acceptable during a ceremony in church. Human behavior is predictable in that individuals behave differently between situations, yet the same within them. Thus, to the extent that non-criminal behavior is predictable, criminal behavior is also, as criminals are unlikely to choose targets in areas or within situations that may draw attention to their delinquency. Offenders will not choose areas or times of the day that run a high risk of detection and will not
choose targets or victims that would make the commission of a crime exceedingly difficult.

The acknowledgement that the offender and his surrounding environment interact bi-directionally is arguably, one of the most salient assertions Brantingham and Brantingham (1978b) state in their theory of crime site selection. The environment is said to emit numerous spatial, cultural and social cues that are perceived by the offender who then uses such cues to identify suitable target areas. The consistency with which criminals consider such factors in target selection processes and their pervasiveness within the crime template and criminal event equation is the pattern in and of itself.

Hence, this model of crime site selection can be visualized, if only simplistically, in the following bi-directional manner:

\[ \text{Crime Site Selection} = \text{Offender Cognition} \rightarrow \text{Environmental Cues} \rightarrow \text{Offender Cognition} \]

Within the crime template will also exist a victim template, or a preferred type of target. Brantingham and Brantingham (1991) explain that the spatial distribution of crime sites may vary as a function of the spatial distribution of the target itself (uniform vs. non-uniform target spatial distribution) and its proximity from the offender’s home. As such, Brantingham and Brantingham (1984) define an ‘activity space’ as the area from one’s home base made up of the usual paths taken to and from frequently visited ‘activity nodes’ (e.g., school, work and entertainment). Additionally, an ‘awareness space’ is one’s general level of
knowledge of a city they reside in and subsequent surrounding areas. If the offender's target is uniform in nature (equally available spatially within the city), and the awareness space is non-uniform in nature (spatially clustered in a certain area), the targets are most likely to be located close to the offender's activity nodes (frequented establishments during one's routine activities) or along the most frequently travelled paths (Brantingham and Brantingham, 1991). This is due to the 'least effort principle' (see Warren, Reboussin, Hazelwood, Cummings, Gibbs and Trumbetta, 1998; Alston, 1994; and Rossmo, 1994) as people in general aim to maximize rewards while minimizing effort. Why would an offender choose a distant target that is readily available within a close proximity? This logic applies to daily non-criminal activities in general; if one is in need of groceries, one is unlikely to travel to a store that is 20 km away, but to the closest store available, as the 'target' (groceries) is readily available at numerous outlets. It is held that criminals perceive targets in a holistic or categorical manner and that this image is represented in the crime template (Brantingham and Brantingham, 1978b). It is believed that the holistic image is gestalt-like in that it represents more than the sum of individual details and that the criminal is able to perceive the target comprehensively within the decision of target suitability (see MacDonald and Gifford, 1989).

The exception to this pattern, with regard to criminal activity, is the immediate area within which the offender resides. While criminals are likely to be most familiar with the area surrounding their home base, they are also most likely to be seen or detected there as well; such an area carries a high level of risk to
the offender. Brantingham and Brantingham (1981) discussed this “zone of relatively decreased criminal activity” (p. 32) within the discussion of the spatial elements of criminal search processes. Thus, it was hypothesized that in looking upon target selection spatially, there would be an area immediately surrounding the home base where offences are less likely to occur. This spatial pattern has since been termed the “buffer zone” (Rossmo, 1995) and has been assessed empirically (Canter and Larkin, 1993; Sapp, Huff, Gary, Icove and Horbert, 1998; Warren et al., 1998 and Canter, Coffey, Huntley and Missen, 2000). The present study explores the buffer zone in the spatial target selection patterns of serial arsonists and is referred to as the “avoidance zone” by the researcher (see Chapters Four and Five).

If the offender’s crime template includes a non-uniform target preference encompassing specificities, (i.e., a certain age group, gender, or type of establishment) the spatial distribution of crime sites may extend farther out from the offender’s awareness space and activity nodes, depending upon the extent to which the specific target is readily available within those spatial parameters. In the case of multiple offenders whose crime templates encompass uniformly available targets, the pattern of crime site selection would likely be close to the activity nodes within areas inhabiting the offenders, such as central business districts with high commercial use (Brantingham and Brantingham, 1981; Rand, 1986). If a target were non-uniform in nature with multiple offenders in the equation, the pattern would then be expected to surround the greatest concentration of targets. For example, if the target were automobiles, the pattern
of crime site selection would mostly likely cluster in locations where there are parking lots such as shopping centres and high traffic or high density streets in business cores of a metropolis. Thus, the spatial distribution of crime sites varies as a function of the offender's geographical proximity to the desired target.

Research in the field of Environmental Criminology has established that offenders, more often than not, commit their crimes close to their place of residence (Alston, 1994; Canter and Larkin, 1993; Fritzon, 2001; Rossmo, 1994)). Brantingham and Brantingham (1984) call this phenomenon 'distance decay' and explain that the rate of interactions between people and their surroundings decrease as the distance from home increases. This may be due to the fact that travel is costly (e.g., gas prices), the non-existence of a vehicle or because of a preference for one's immediate surroundings. Within the distance decay model, one could predict that criminals are most likely to offend within their activity space (close to home) as that area provides familiarity, predictability and is within the awareness space and thus does not require traveling far.

Within this environment are pathways; the routes between the activity nodes that criminals frequent and may be roads, transit routes and highways. They are usually located within the awareness space. In addition, Brantingham and Brantingham (1993b) describe the salience of edges (i.e., places where there is enough distinctiveness between one area and another that a change is noticeable) in an offender's crime template and target selection processes. For example, residential areas have edges between where the majority of homes are located and where the major road networks intersect with side streets. It is
stated that edges have notoriously high crime rates (see White, 1990) in that strangers can come and go easily, as the volume of traffic is greater and thus detection is less likely.

The extent to which a criminal will travel to commit a crime will also vary as a function of the perceived distance to a desired target on the part of the offender, and the geographic size of their awareness space (Brantingham and Brantingham, 1984). How large is the city in which they live? How many high volume activity nodes are there such as shopping malls, bars or parking lots? A diffuse activity space is equated with an even larger awareness space and may result in a sizeable radius of target selection and criminal activity. The selection of a target itself is far from random in nature, as targets are not evenly distributed as they vary across both space and time (Brantingham and Brantingham, 1984). Certain areas of a city embody more persons, crowds and property such as clustered housing and parking lots full of cars, all of which provide opportunity for criminal victimization. On a similar trajectory, targets vary in accessibility with the time of day, as there are far more cars parked on city streets during work hours and far more residences left unattended during the same time frame. The 'crime occurrence space', where the criminal and the target come in contact with each other does not happen randomly; rather is reflective of numerous decisions made on the part of the offender as they weigh the level of opportunity with the risk of being caught.

Brantingham and Brantingham (1993a, 1993b) stress that the crime template, though a pervasive part of the criminal event, is not constant in nature;
its maintenance may change with the offender's experiences. Should an offender move and the awareness space be altered, or if he or she receives information from other offenders of areas encompassing attractive targets, he or she may travel to such areas even if they exist in more distant spatial parameters. In essence, the crime template demonstrates predictable spatial patterns, yet the existence and salience of this template within the criminal event equation is more reliable than the specifics of each template itself. The extent to which a crime template endures is based on the success of the crime (Brantingham and Brantingham 1984). Successfully carrying out a crime would serve as a reward, positively reinforcing the template and increasing the likelihood of capitalizing on similar targets in the future.

Most criminal events consist of the following equation: the place and time at which the crime occurred coupled with the offender and victim. Focusing on the spatial factor in the equation, such an analysis can be implemented at three levels. At a macro level, researchers may compare the spatial pattern of criminal activity, as it exists between countries or continents, yielding international data. At a meso level, researchers may compare the criminal patterns existing between cities or between census tracts or census subdivisions. At a micro level, researchers look at pattern variation within cities or even between city blocks. At this level of analysis, the activity nodes of an offender are also considered in addition to the offender's routes between those nodes (Brantingham and Brantingham, 1984).
The most common and perhaps most significant error committed in spatial analysis is the application of areal or ecological correlations to individual or micro level analyses. This most often occurs when spatial data and socioeconomic data are amalgamated to generate aggregate patterns attempting to explain individual variation in criminal activity. This is referred to as the 'ecological fallacy' and is defined as “arguments that inappropriately apply conclusions reached from one spatial level of analysis to another” (Brantingham and Brantingham, 1984, p. 228). For example, if crime is found to be positively related to the percentage of persons renting at aggregate levels, one cannot then assume that a person who rents a suite is more likely to commit crime or be victimized. This is due to the limits of the data. Such data do not allow the researcher to ascertain if it is in fact the 'renters' who are committing the crimes; perhaps criminals are traveling to areas that happen to consist of high rental rates, or it may also be that the criminals are victimizing the few non-renters living in the area, yet due to the high rental rate and high criminal activity, the two are inaccurately linked. Potential explanations for individual variance of crime are as numerous as the individuals themselves. This study is based on a micro-spatial analysis of the distance traveled from residence to crime scene based on individual arson cases. Thus, the results cannot be extrapolated to aggregate level patterns, only towards individual offender target selection processes.

Social Ecology and Criminal Behaviour

Another eminent contribution to Environmental Criminology can be found within the field of Social Ecology. The field of Social Ecology has been applied to
the study of criminal behavior in looking at how environmental forces account for variations in criminal activity and assessing how socio-demographic characteristics affect the likelihood of offending and/or victimization. The discussion of this field will commence with the seminal work of Park, Burgess and Mackenzie followed by that of the Chicago School of Criminology and conclude with those of Felson and Cohen.

Park, Burgess and Mackenzie's (1925) work on the emergence of the city, its expansion and the resulting social effects of such change were influential in the application of social ecology to criminal behavior. Specifically, with regard to delinquent behavior, Park et al. (1925) proposed that such activity could be explained by the structure of the urban environment, specifically the growth of a city center. Such a proposition is indicative of social ecology in that any spatial component discerned within criminal activity would be linked to its existence within a city center and not a result of any connection between the criminals themselves and their tie to a familiar area. It thus removes any psychological or cognitive component to the examination of criminal behavior and focuses solely on how social forces, beyond the realm of the offender, generate delinquency and any concomitant patterns.

According to McKenzie (1925), the emergence of a city may begin with any number of social or ecological changes such as an influx of population, the development of important public buildings, the introduction of new industries or development of real estate. As a by-product of urban materialization, there develops increased competition for land and resources resulting in populations
being forced outward from the city centre to outlying areas; creating what is termed today as the 'suburb'.

The city centre, according to McKenzie (1925) is an area encompassing high mobility as transit routes favour directions to and from the urban core. Once the city centre expands and forces occupants outwards, it becomes surrounded by general deterioration inhabited by persons McKenzie termed 'undesirable invaders'. It is at this point that the city sees the greatest concentration of poverty, vice, crime, juvenile delinquency, divorce, desertion, abandoned infants, murder and suicide (Mackenzie, 1925, p. 153). The outlying areas from the city centre consequently are inhabited by former residents of the city centre who often migrate outwards to avoid invading populations and to perhaps attempt to maintain their sense of identity. In looking further at the causes behind city growth and subsequent social-ecological effects, Burgess (1925) provides a detailed discussion of the process of expansion (of a city centre); this explanatory model and its application to criminal behaviour will be reviewed next.

Burgess (1925) holds that the primary 'cause' of the expansion of a city is population insurgence. Using a concentric zone model, Burgess represents both the social and geographical effects of expansion initiated by population growth. Expansion itself is the tendency of each zone to filter into an outlying area due to increased population. The model begins with the city centre, or the "loop" where new populations bring increased growth of industry and development. The next zone projecting outwards from the city centre is termed the "zone in transition" where businesses emerge whose desired clientele include the newer "invading
populations” residing in the neighbouring developing city centre. Burgess held that the third zone emerging within the growth of a city centre would include the workingmen’s homes. This area would comprise of the residences of those wishing to balance the desire to avoid the deleterious environment of the changing city centre while living close enough to maintain easy access to their work locations. Projecting further outwards in the concentric zone model is the “residential zone” which Burgess holds as containing the higher-class apartment buildings and single-family dwellings. Lastly, the fifth zone is the “commuters zone”, similar to the ‘suburb’ where families would likely reside and the area would require a 30-60 minute drive to the city centre.

With regard to social disorder, Burgess (1925) states that in the burgeoning central business district, rapid expansion is “accompanied by excessive increases in disease, crime, disorder, vice, insanity and suicide” (p. 57). To explain why this occurs, Burgess distinguishes between the concepts of movement versus mobility. Movement is said to be the unchanging order of motion such as where one goes from home to work and back home at the end of the day; a consistent situation. Mobility, though, is said to be movement that is in response to a new stimulus or condition. The central business district holds innumerable sources of stimuli that might propel one to alter their movement patterns creating a situation leading to mobility, tempting one to engage in behaviours previously not considered perhaps due to opportunity. Burgess holds that the city centre holds great mobility for incoming populations, with inordinate sources of stimulation and may “confuse or demoralize the person” (p. 59).
Thus, the concept of mobility is intimately linked to that of criminal activity, the area encompassing the highest level of mobility is also considered the zone most likely to evidence crime as a by-product of its demoralizing nature.

In attempting to explicate how social forces affect the growth of a city, Burgess (1925) differentiated between ‘factors’ and ‘forces’ and in doing so defined a factor as a concrete cause for an individual event and a force as an abstract cause for a general event. It was explained that with the emergence of an urban core and the subsequent movement towards outlying areas, there occur changes on various levels (geographical and social) in all such locations. Factors and forces represent an attempt at explicating how and why a developing city center may instigate change in other areas surrounding the city. This discourse involved the issue of crime. For example, Burgess explained that individuals possessing a group identity living in a city is a factor within that region and may be linked to social conflict or crime. However, upon the emergence of an urban core, such groups are forced outwards; each group may settle into various outlying areas and form what may be termed a ‘gang’. It is at this point that such groups develop into a force propelling social change and delinquent activity within all outlying areas in general. Furthermore, in this discussion of the growth of a city, the phenomenon of the community enters. Community may be viewed in terms of a fixed location, communal life of a given area and the maintenance of a local culture or in the development of cooperative behavior as a byproduct of living in a common residence or perceiving one’s neighbors and
oneself as a unique group. Burgess termed this “community consciousness” (p. 146).

Community change as a result of the development of an urban centre is seen as being linked to ecological, cultural or political forces (Park, Burgess and Mackenzie, 1925). However, with regards to criminal behaviour within community change the largest emphasis is once again placed on increased mobility as a by-product of the emerging cities. For example, once a population grows and the city centre inhabits larger, more diverse populations, mobility is said to reflect the growing transient nature of the city that accompanies such change and may contribute to one of two primary scenarios leading to delinquent behaviour. One, increased mobility may open the opportunity for youths living in similar areas to escape the controls of their family, homes and neighbours and travel into areas where they are anonymous and less guarded. Secondly, increased mobility may give opportunity for youths living in different outlying areas to come together in developing city centres and feel free to engage in delinquent behaviour without the fear of being recognized.

Thus, the growth of a city, often beginning with population influx, may result in the emergence of an urban-core-inhabiting transient and foreign populations, creating an environment conducive to criminal activity and social conflict. It is from such propositions that Shaw and McKay began to examine areas containing criminal residences and how social and ecological change becomes a force affecting criminal behaviour within major urban centres and
outlying areas. The next section will discuss these studies and the seminal work of Shaw and McKay.

From 1929 to approximately 1969, Clifford Shaw and Henry McKay conducted a series of studies looking at crime in the city of Chicago. Specifically, locations of offenders' residence were mapped onto a base map of Chicago and subsequently analyzed to note spatial clusters and more importantly, to identify structural/community characteristics definitive of such areas; leading to an explanatory model of offender residence variation.

The key assumption was that the delinquent residence rates should be highest near the center in the city of Chicago and decline with increasing distance from this center (Brantingham and Brantingham, 1984). Also, if the areas amongst the city center were structurally clustered, the delinquency residence rates should be similar between such areas. This assumption connotes that proximity is conjoined with similarity. Shaw and McKay also assumed that if anomalous residence rates were found in an area, it may be due to either the atypical geography of that zone, or a function of the presence of regulators of delinquency such as parents, or increased police patrol. Lastly, it was assumed that criminal residence rates should be expected to change with time as certain areas previously viewed as suburbs begin to urbanize and subsequent diverse populations begin to inhabit and compete with each other for space within such areas. Burgess (1925) termed these social changes as 'expansion' and 'metabolism' respectively. Upon population growth in a city, the city center begins to expand outward so that commercial and industrial areas
begin to merge with residential areas. As the city center expands outward, zones in transition are subsequently created. Burgess reiterated that this process of expansion may cause a displacement of residents from their homes and conflicts may ensue as differing populations compete for cultural dominance. This adjustment (metabolism) was linked to the human desire for control over one's physical and social space.

The results of the Chicago Model study positively confirmed all four hypotheses in that criminal residency rates were found to be clustered in the center of the city of Chicago and decreased in frequency as the distance from the center increased towards the periphery (Brantingham and Brantingham, 1984). The Chicago Model offered immense support for the application of social ecology to the study of crime, yet it was not without limitations and errors. Shaw and McKay inferred that because the highest proportion of delinquency residence rates were found in areas exhibiting run-down housing and foreign immigrant populations, such individuals must have succumbed to the social pressures of their inept surroundings; thereby leading them to criminal behavior. Such a conclusion is an ecological fallacy. The data do not establish such relationships as one does not know whether it is the individuals inhabiting these areas that are committing crime, or if criminals are traveling to these areas to commit crime because they perceive it as embodying attractive targets. On a similar trajectory, a differentiation between 'criminal areas' and 'crime areas' was not established in that they assumed wherever the criminals were residing was also the area that
crimes were being committed. The two areas are not always congruent as criminals may travel outside of their home area to commit crimes.

Lastly, it must be stated that such findings do not shed light on why criminals are residing in such areas; the nature of aggregate correlations precludes one from hypothesizing on an individual level. It would be interesting to discern whether it is the area that is attractive to the offenders due to its geography or cost, or if the cluster of offender residences are in part due to criminals choosing to "stick with" one another as it is natural for individuals to socialize with those to whom they share mutual interests and activities with. Shaw and McKay's (as cited in Brantingham and Brantingham, 1984) Chicago Model does not answer such questions.

Marcus Felson and Lawrence Cohen have written extensively on how trends in social structures can alter crime rates in their theory of 'Routine Activities'. The main assumption of this theoretical standpoint is that individuals engage in routine, day-to-day activity occurring within one's home area (Felson and Cohen, 1980). When an individual's routine activities change (taking one outside of their activity space) and there is an absence of a capable guardian (ex. a partner or friend), the probability of offending and/or victimization is increased. Focusing on violent predatory crime in which a criminal intentionally targets a person or property, Felson and Cohen hold that target suitability is comprised of four components: the perceived value of the target, how visible the target is, the level of accessibility of the target with regards to entry and exit, and the inertia of
the target in terms of the extent to which it can be moved. All of these components reflect how easily a crime may be carried out.

Felson and Cohen (1980) applied the Routine Activities approach in attempting to explain the rising burglary rates in the U.S. during the period from 1950 to 1972. Using only three variables, the researchers were able to account for 98.6% of the variance in the burglary rate. The variables used were the percent of the population aged 15 to 24 years, the percent of households classified as 'primary individual households' and the weight in pounds of the lightest TV set advertised in the Sears catalogue. The variable of persons aged 15 to 24 was most likely used, as it reflects the age range of the vast majority of both offenders and victims of property and violent crime in the U.S. The primary household variable alluded to households in which only one person resided and also worked, leaving the property unattended and unguarded for significant parts of the day. The weight of the TV set illustrated the effects of the inertia of a target; the lighter the TV sets became in the U.S., the easier they were to steal and transport from residences.

Felson and Cohen's (1980) model of Routine Activities possesses large explanatory capability for aggregate variances in criminal activity. The most significant insight provided by the theory is the acknowledgement that crime takes place within the context of daily routine activities. 'Routine activities' are defined as any recurrent and prevalent actions, which provide for basic population and individual needs: biological, social or cultural (Cohen and Felson, 1979). As these activities change, and one is removed from the familiarity of
their surroundings, the probability of victimization (and offending) is increased as one is disconnected from the safety net of family and friends. Thus, there exists an inverse relationship between the tempo (or frequency) of legitimate routine activities within the home and the tempo of illegitimate activities outside of the home (Felson and Cohen, 1980). Specifically, in regard to direct-contact predatory violations (such as robbery) Cohen and Felson (1979) propose that changes in legitimate routine activities lead to the intersection of likely offenders and suitable targets in the absence of capable guardians and that crime rates are affected by the likelihood of the above three factors converging without extraneous changes in the proportion of criminally inclined individuals (Felson and Cohen, 1980).

Routine Activities Theory consists of three propositions regarding the occurrence of a direct-contact predatory violation. The first is that there must be a convergence in space and time of the aforementioned variables in order for the crime to occur. Additionally, the lack of any one of those elements would preclude the criminal event from occurring (e.g., one cannot commit a predatory offense without a victim or in the presence of a capable guardian). Lastly, Cohen and Felson assert that explanations of rising crime rates which focus on higher proportions of likely offenders or victims in a population alone are misguided; rather, explanations should focus on the circumstances that have led to increases in the convergence of both offenders and victims in situations where a capable guardian is absent. Thus, if the percentage of likely offenders and victims remained constant, yet the legitimate routine activities were changed in a
manner leading to a higher rate of convergence, Routine Activities theory would hold that one would see a concomitant increase in the rate of direct-contact predatory violations.

It was highlighted at the time of the research that legitimate routine activities of Americans were changing dramatically in that a higher proportion of the population was working outside of the home (particularly married women) and that many persons were engaging in activities that required them to leave their residence or immediate neighborhoods and venture into urban areas to attend school, work or simply to enjoy leisure activities. Felson and Cohen (1980) pointed out that such mobility brought together persons from differing backgrounds and created an environment suitable for criminal activity with the advent of public transit, transit stations, shopping complexes and bars and discos clustered in downtown areas. Such venues amalgamate large crowds of persons who do not know each other, are separated from suitable guardians (e.g., parents, spouse, and neighbors or police) and increase feelings of anonymity. For example, it is argued that the increase of married women’s participation in the labor force created more opportunity for two types of crime, burglary, with more homes being vacant during weekday business hours and street robbery, where women had a higher chance of being victimized as they ventured away from the safety of their homes and neighborhoods (Felson and Cohen, 1980). Thus, Routine Activities Theory provided insight and testable propositions that would help explain the pattern of criminal events and their disproportionate occurrence in certain areas and at certain times. A visualization of a Routine
Activities theoretical explanation of the criminal event could be represented as the following, with each variable encompassing equal value:

\[
\text{Criminal Event} = \text{motivated offender} + \text{suitable target} - \text{capable guardian}
\]

Cromwell, Olson and Avery (1991) provided an ethnographic account of burglar's decision-making processes. In doing so, it was revealed via interviews with the burglars that the manner in which the homes were targeted reflected a Routine Activities framework. For example, one burglar recounted that he would frequently ride his bicycle through a neighbourhood and target homes he perceived as attractive, that were located on his bicycle route. Another burglar stated that whenever he visited his friend, he would keep an eye out for potential homes to burgle in that area. It was clear from the ethnographic accounts that frequented activity nodes part of the burglar’s routine daily activities served as bases from which target selection would occur in its initial stages. Thus, upon the opportune moment where the burglar is motivated to commit the crime, a suitable target (i.e., a home that is unoccupied) and the absence of guardians, the burglary was likely to ensue; homes being situated in areas frequently visited being the most probable targets.

Cromwell et al. (1991) conducted a quantitative analysis to ascertain whether the ethnographic accounts reflective of a Routine Activities framework would prove salient statistically. Using a stepwise discriminant analysis, the researchers sought to determine which variables (from a Routine Activities
framework) best discriminated between homes that were reported as being burgled and those not targeted. The results demonstrated that homes near frequented activity nodes that people in general come across or pass daily, are the most likely to be targeted. Specifically, if a home was close to a school, four lane traffic arteries or farther from well-known businesses, they were more likely to be targeted. Additionally, if a home was on a street with a slower posted driving speed or did not have a garage blocking an outsider's view of the premises, the home was also more likely to be targeted. These five variables accounted for over 50% of the variation between burglarised and non-burglarised homes and correctly identified 90.5% of the burglarised residences and 80% of those homes not targeted. The results indicate that as the burglars go about their everyday routine activities they are looking out for potential targets and homes situated in close proximity to roads or locations frequented by the burglars and homes easily accessed are those most likely to be targeted. For example, Cromwell et al. found that 39% of the burglarised homes were located on a corner, arguably a location that is highly visible from passers-by and those driving through the neighbourhood. These homes, however, only made up 25% of the total houses in the study. The results strongly support the central tenet of the Routine Activities framework; criminals engage in routine day-to-day activities as do non-criminals and it is within the areas encompassing the frequented activity nodes and travel routes that criminal activity takes place; where targets are detected and the offence committed. Cromwell et al.'s study also lends insight into the formation of a crime template (Brantingham and Brantingham,
1984). Brantingham and Brantingham hold that the specific details of the crime template may differ as a function of the offender's geographical location; are they situated in a city or a suburb, their routine activity patterns and travel routes; do they travel by car or on foot or by transit? The homes that were perceived as being suitable targets and subsequently burgled differed depending on whether the burglar drove through the area frequently or rode his/her bicycle through it, etc. These results demonstrate that what constitutes an attractive target within the burglars crime template will reflect his/her life circumstances and daily activity patterns as posited by Brantingham and Brantingham (1984).

Routine Activities Theory is accepted as an invaluable perspective within Environmental Criminology and is seen as holding explanatory capabilities with regard to criminal activity in the aggregate. It is also one of the bases from which Pattern Theory (Brantingham and Brantingham, 1993a, 1993b) is organized and is thus discussed here as a precursor to that theory.

**Rational Choice Theory**

The key tenet of Rational Choice theory is that crimes are never senseless; rather they are purposive and the result of a conscious decision making process on the part of the offender intended to bring benefit or reward their way (Clarke and Cornish, 2001). The theory explains the conditions needed for specific criminal events to occur and that the conditions leading to the commission of a crime will differ depending on the situational circumstances. It also makes little distinction between the decision making processes of offenders and non-offenders; all persons engage in decisions that attempt to maximize
reward and minimize effort or lead to a result that benefits oneself. Rational Choice theory focuses on how criminal opportunity plays a central role in criminal activity and prides itself on being policy oriented and applied in nature. The theory is an integral contribution to the field of Environmental Criminology and as will be discussed later, to Pattern Theory as well.

Rational Choice theory embodies six key propositions. First, that crime is purposive and as such should never be viewed as irrational or senseless; one ought to attempt to view the criminal event from the offender's perspective in order to understand potential factors involved in decision-making (Cornish and Clarke, 2001). Second, due to the fervent belief that the goal of any criminal activity is to bring a perceived reward or benefit to the offender, criminals may not always make the best decisions at the point of commission; yet that the desire to gain a reward is the basis of all criminal activity and is a pattern in and of itself. Clarke and Cornish (2001) respond to claims that much of criminal activity appears irrational in nature (e.g., domestic assault) by arguing that such decisions may often occur in the presence of various limitations within the offender's capability to clearly assess his or her surrounding circumstances. Offenders often make quick decisions in deciding whether to commit a crime and this decision process is vulnerable to time, resource and information limitations. For example, a criminal may decide to commit a burglary in a home that is known to be ample in expensive electronic goods, however, the criminal may not be aware that the owners installed a current alarm system in the residence that was not there before.
Third, Clarke and Cornish (2001) propose that offender decision-making varies with the nature of the crime. In other words, to say that the basis for all criminal events is to gain rewards or benefits is too simplistic in nature. They argue that the perception that one will profit from the criminal activity is a general factor propelling one towards such behaviour; however the contexts in which such perceptions may arise differ greatly depending on the offence itself. The crime of burglary involves different factors and circumstances than sexual assault; one involves the acquisition of property by theft and the other involves sexual gratification through the victimization of another human being. Clarke and Cornish expound upon this proposition further by stating that even within crime types lay variation in contexts that effect offender decision-making and renders legal categories such as burglary vs. robbery too broad when engaging in an explicative discourse on criminal behaviour. For example, within the crime of theft, the circumstances and concomitant decisions will differ greatly depending on whether the theft involves a car, a residence, a business or an identity. Thus, Clarke and Cornish (2001) hold that even when the same criminal engages in different types of crimes, each crime is the result of disparate decision-making processes embodying specific and unique motivations.

Rational Choice theory also proposes that engaging oneself in criminal activity reflects two types of decisions: involvement decisions and event decisions (Clarke and Cornish, 2001). The involvement decisions are seen as encompassing three stages: the initiation stage of commencing the criminal behaviour, the continuation of it and finally its cessation. The event decisions
involve choosing particular targets and thinking about ways to avoid detection or apprehension. Clarke and Cornish (2001) argue that even within the same offender, if different crimes were committed, both the involvement and event decision-making processes would demonstrate different models. For example, each crime involves different perceived opportunities, represents differing challenges, requires different contacts and presents varying risk and reward levels.

Lastly, Rational Choice theory expounds upon the involvement decisions by recognizing that the decision to initially involve oneself, continue or stop criminal activity will vary as a function of the offender’s background characteristics, current life circumstances and the situational variables at the time in question (Clarke and Cornish, 2001). It is argued that the salience of these variables will differ within the involvement decision-making process at each stage (initiation, continuation and cessation of criminal activity); however, the main tenet of Rational Choice theory is that the consideration of such factors is always present within that process for the offender. Lastly, Clarke and Cornish (2001) stress that the event decision-making process encompasses more than the selection of targets alone. It begins with what target ought to be selected, where one goes to obtain such a target, and when/how will the criminal activity carry itself out. Amalgamating all these concepts is the term ‘crime scripts’, which infers a step-by-step account of the procedures used by offenders to commit crimes. It is argued by this researcher, that the crime script of Rational Choice
theory is similar to the crime template in Pattern Theory, which will be discussed in the next section of this chapter.

The propositions found in Rational Choice theory have been utilized within the field of Environmental Criminology. The principle that criminal behaviour is the result of purposive decision-making is integral to the Brantingham’s model of crime site selection and concomitantly within the work of Rossmo’s (1995) Geographic Profiling. Clarke and Cornish (2001) hold that the target selection processes of serial murderers reflects active decision-making in choosing areas to target that are within one’s activity space; those places routinely visited during daily patterns of work and leisure. Clarke and Cornish indicate that a conscious decision is made on the part of the serial criminal in deciding where and how to commit the crime; and that such processes are so pervasive that they have led to the success of Rossmo’s (1995) Geographic Profiling where the approximate residential location of a serial offender is predicted based on the locations of linked crimes sites. Geographic Profiling, based in Environmental Criminology, necessitates the assumption that a rational decision making process is occurring and that the serial offender has actively chosen certain areas to target due to their level of familiarity with the area, their concomitant confidence level at functioning within that area and a probable perception of a low risk of detection.

Additionally, Rational Choice theory prides itself on being policy driven and applied in nature. In this regard, its main principle that criminal events occur purposely for the benefit of the offender, has been applied to the area of crime prevention; a subset of Environmental Criminology. For example, Clarke and
Cornish (2001) reiterate how airline hijackings have decreased substantially due to baggage screening and that such a result is reflective of a process that increased the perceived risks by the offender. Also, increasing the perceived amount of effort required for the successful commission of a crime, reducing the anticipated rewards and/or removing the excuses for the criminal behaviour are other applied methods used within crime prevention that are argued as originating from the principles of Rational Choice theory.

Rational Choice theory as it applies to criminal decision-making has been challenged. Cromwell et al. (1991) question the validity of studies that suggest criminals engage in purposive or planned decisions based on an evaluation of their environments. This is due to the discrepancy found in their ethnographic study of burglary between the information obtained from the burglars in interviews and what the researchers observed during ride-a-longs. Cromwell et al. found that when the burglars were asked to recall their decision-making process leading to a burglary, that the recollections were reflective of professional considerations and attributed their criminal activity to calculated decision-making strategies weighing the potential gains against the potential risk factors. However, upon observation, the researchers noted that their decisions of whether to commit a burglary were based far more on opportunity than careful considerations. Cromwell et al. termed the burglars proclivity to recall their decision-making processes as purposive, "rational reconstruction" as they preferred to recall their decisions in a manner consistent with what "should have been" rather than "what was" (p. 42). In reality, the researchers observed that
the burglars often decided to commit their crimes when an opportunity arose within circumstances conducive to the successful commission of the crime. For example, one burglar stated that in driving home from a party he happened to notice that a home he was monitoring appeared to be unoccupied and took advantage of the “opportunity” and broke in; a decision-making process far more impetuous than what would be suggested by Rational Choice theory. Despite these findings, Cromwell et al. suggest that acting upon opportunity does not denote a lack of rationality. Once criminal opportunity presents itself, a burglar may rationally decide to either act upon the opportunity or to decline it. Thus, Cromwell et al. propose that burglar’s decision-making processes embody a combination of rational considerations and responsive behaviour when presented with opportunities.

As a prelude to the discussion of Pattern Theory, it is imperative to note how Rational Choice theory provides a basis from which a discourse on the non-random nature of criminal offence patterns may ensue. The assumption that criminal behaviour is purposive and rational and that there exist in society those who are criminally motivated is one of absolute essentialness for the key proposition of Pattern Theory; that criminal behaviour is non-random, patterned and discernible in terms of its spatial and temporal attributes (Brantingham and Brantingham, 1993a). Both theories assert that it is futile to concentrate on the motivations behind criminal activity (deep-rooted inclinations to commit crime), as they are so numerous that studying such an area becomes ineffective when attempting to discern patterns. However, focusing on the criminal motives
(situational and circumstantial) is arguably advantageous as it leads to the projection that despite the seeming complexity within which criminal events may occur, there exist patterned criminal motives, particularly within target selection and the cognitive interaction between one's environment and the purposive decision of where to commit an offence and when to do it. The belief that such factors are pervasive in all criminal activity is the discernible and reliable pattern in and of itself. If all criminal activity (excluding those of the mentally ill) arise from such rational decisions, it is then fitting to ensue in a discourse further exploring the distinct non-random spatial pattern regarding where criminal events take place and how offenders select their targets. This is because the assumption of rationality allows one to infer that the non-random spatial characteristics of criminal behaviours are in fact patterns; the word pattern indicates that the behaviour assessed is repeated and thus likely the result of a purposive choice on the decision maker- the criminal in this case. In the absence of this assumption, the criminal behaviour would be seen as random or irrational, precluding the capability to offer the explanation that the repeated spatial characteristics of criminal behaviour are in fact patterns and not mere coincidences.

**Pattern Theory**

In conceptualising the bases of Pattern Theory, Brantingham and Brantingham (1993a) propose that despite a seeming complexity within which criminal events occur, there exist discernible patterns that if recognized, offer strong explanatory capability towards the non-random and non-uniform
spatial/temporal pattern of crime occurrence that has been identified for decades. ‘Pattern’ itself is described as a recognizable interconnection of objects, processes or ideas (Brantingham and Brantingham, 1993a). The Brantinghams acknowledge that the etiology of the criminal event is complex in nature and that the complexity must be recognized within any theoretical explanation of criminal behaviour; yet it is held with equal fervour that crime occurs within a patterned context that is comprised of the offender’s social, psychological, spatial, legal and cultural history and surroundings. All such factors combined affect the decision-making process that underscores the commission of the criminal event in various ways, yet the existence of such a context and the fact that such variables collectively and consistently shape the criminal event, is a pattern in and of itself. The Brantinghams, in Pattern Theory, recognize both what constitutes the complexity of the criminal event and, more importantly, discern what patterns are evident and constant within that context.

Specifically, the complexity within which the criminal event occurs is accounted for by the term 'environmental backcloth' (Brantingham and Brantingham, 1993a; 1993b). It is described as the ever-changing set of socio-cultural, economic, legal, structural, and physical surroundings that include, among other things, the activities of individuals, groups and organizations. Behaviour, both criminal and non-criminal is believed to be influenced by the environmental backcloth in patterned ways. For example, Pattern Theory holds that the activity space, activity nodes and general awareness space collectively constitute a part of the city that one has knowledge of, functions within and is
familiar and comfortable. Brantingham and Brantingham (1993b), for example, explain that because criminals engage mostly in non-criminal activity, that the activity nodes within one’s awareness space are areas most likely to be favoured in target selection. Depending on where the offender lives and the type of target he prefers, the awareness space may affect his spatial mobility or how far he decides to travel to commit a crime.

The activity nodes, pathways and edges are representations of the ways in which the physical environment affects offender mobility in terms of target selection and are essential components of Pattern Theory. According to the theory, the likelihood of a criminal event occurring reflects the extent to which the environmental backcloth, the crime site location, the offender’s readiness level, the routine activity patterns of both the offender and victim and the distribution of targets in space and time conjoin in a manner conducive to the successful commission of a crime (Brantingham and Brantingham, 1993a). Within these three elements, Pattern Theory specifies four propositions; that one must analyse the event process, the crime template of offenders including his or her routine activities, the readiness level and the interaction within the three aforementioned factors in explaining the criminal event.

The first proposition holds that for every crime, there is an event process resembling the sequence of events that lead to the actual crime. Brantingham and Brantingham (1993a) state that preceding all crimes are triggering events that are perceived to be sufficient to warrant the decision, conscious or unconscious, to engage in the illegal activity. It is acknowledged that both what
is perceived to be a sufficient trigger and how the criminal decides to break the
law will differ for each offender and offence type, yet the existence of a triggering
precursor is accepted as a constant pattern and an essential part of the criminal
event equation. For example, a young man with a history of assault is not likely
to instigate a confrontation with any person at any time, however, is far more
likely to engage in such behaviour should he be in a situation where he is
triggered, such as a bar or nightclub where he perceives the behaviour as an
appropriate response to the trigger. The assault is highly unlikely to occur
spontaneously in the absence of a triggering event and the subsequent
perception and decision that the behaviour is warranted.

Should the trigger lead to the decision to engage in the criminal activity,
the second proposition of Pattern Theory holds that the routine activities of the
offender and his or her crime template must be considered at the moment of
commission. Understanding the offender's crime template would give insight into
what constitutes an attractive target or victim and what circumstances the
offender perceives to be conducive to the successful commission of the crime. If
the offender has engaged in criminal activity before, the elements of the crime
template will likely be reflective of such past experiences; characteristics linked to
previously successful crimes (however 'success' is defined) may become
positively reinforced and serve as one of the bases from which the decision is
made to commit the crime or not (Brantingham and Brantingham, 1993a).

Whether the criminal is a first time offender or a seasoned veteran, Brantingham
and Brantingham (1993a) hold that the routine activities of the individual are
elements that will affect the criminal event in patterned ways; as such it is essential to recognize that criminals for the most part, function as non-criminals in daily activities. Routine activities form the activity space and are comprised of the activity nodes embedded within the general awareness space of the offender. It is within such areas that the criminal is most likely to offend, as the activity space constitutes the area of greatest familiarity, predictability and arguably, the offender feels most confident functioning within those spatial parameters.

The third proposition of Pattern Theory, in assuming the existence of criminally motivated individuals, states that a 'level of readiness' is a necessary precursor for the commission of a crime and that this may differ for each offender depending on the intersection of the activity backcloth (daily routine activities) of both players in the criminal event equation; offender and victim or target (Brantingham and Brantingham, 1993a). However, even in the presence of such a convergence, it is held that the crime would not unfold if the offender were not in a state of readiness to behave in such a way. For example, if a criminal desires to steal cars and came across his preferred model in a shopping complex parking lot (the intersection of the offender and target in space and time), yet was surrounded by security guards and a high volume of business patrons, the offender’s level of readiness may not be conducive to the commission of the auto theft despite the opportunity presenting itself.

Additionally, the level of readiness is believed to vary as a function of crime type in that an offender may not need to experience a high state of readiness in order to commit a petty theft; conversely, he may require a
significantly higher level of readiness to feel confident enough to commit armed robbery or sexual assault. From this proposition, one may follow that the state of readiness precludes the triggering event leading to the commission of the crime. However, one could postulate that a trigger alone would prove sufficient to warrant criminal behaviour especially in the context of violent crimes against persons, as they are often more spontaneous in nature. For example, a criminally inclined individual may not be in a state of readiness to commit assault on unsuspecting patrons of an establishment he is frequenting, however, once triggered (e.g., being on the receiving end of a derogatory statement) the crime of assault may occur in the absence of a previously existing state of readiness. Nonetheless, Pattern Theory holds that a certain level of readiness is imperative to the criminal event equation and as such is seen as one of the discernible patterns within crossing the legal line to commit a crime (Brantingham and Brantingham, 1993a).

The fourth and final proposition of Pattern Theory asserts that the interaction of the aforementioned elements collectively produce the criminal event equation. Each element holds a necessary component of the criminal event and together they shape the non-random and non-uniform spatial and temporal distribution of crime. Brantingham and Brantingham (1993a; 1993b) put forth a unique and inclusive combination of variables accounting for both the physical and social effects of the environment on the offender's cognitive decision making processes. The interaction between offender cognition and the surrounding environment is said to be bi-directional in nature. Past experiences
with criminal activity as it exists within the environmental backcloth will affect the offender's decision-making process and either amplify or suppress the readiness or willingness to commit the crime. Brantingham and Brantingham (1993a) reiterate that this ongoing bi-directional interaction of decision-making can be characterized as feedback loops that continually affect the crime template either reinforcing elements of it or altering aspects of it to ensure the successful commission of the crime. In Pattern Theory, the phenomenon of crime is seen as being best considered within a multi-disciplinary context and can only be explained when viewed as occurring within a complex environmental backcloth representing the activity patterns of the two primary players, the offender and victim.

It is the opinion of this researcher, that the inclusive approach demonstrated within Pattern Theory renders the theory highly explicative towards discerning the criminal event. However, it must be noted that despite the theory's explanatory capability, it is unable to infer causal relationships between any elements of the criminal event equation and the occurrence of the criminal event itself. This is due to the nature of theorizing within the social sciences; there exist innumerable extraneous variables for which one cannot control and subsequently measure conclusively. Albeit, statistically, such processes are possible, yet still cannot go so far as to say that one variable (such as the activity node location of an offender's residence) 'causes' the occurrence of another (such as target selection occurring close to home). It can only be suggested that a strong directional relationship between the two exist (i.e., that criminals tend to
select targets in close proximity to frequented activity nodes); not that one is the cause of the other entirely. However, this point does not imply a limitation of Pattern Theory, as the inability to infer causal relationships between the elements of a theory has never precluded one from being upheld as highly explicative of the phenomenon it addresses. On the contrary, Pattern Theory offers the field of Criminology a vast number of variables to consider collectively in the complex analysis of the criminal event equation and as such can be visualized in the following manner:

Figure 1. Criminal Event Equation, Pattern Theory

CRIMINAL EVENT EQUATION =

Environmental Backcloth

Motivated + Target + Crime Template + Trigger + Opportunity

Offender

In the next chapter, empirical research in the area of Environmental Criminology will be reviewed with an emphasis on the distances travelled to crime scenes by offenders within the target selection process.
CHAPTER TWO: EMPIRICAL RESEARCH

Environmental Criminology Research

Research conducted from an Environmental Criminology perspective has substantiated that the spatial and temporal nature of crime occurrence is neither random nor uniform; rather, it exhibits reliable patterns across crime types. The current study holds that research demonstrating the empirical reliability of propositions from both Routine Activities and Pattern Theory warrant the field of Environmental Criminology to be viewed as evolving from a discursive to explanatory and predictive discourse on criminal behavior within the social sciences.

The recognition that crime occurrence is disproportionately distributed was acknowledged as early as the mid nineteenth century. Glyde (1856) in his assessment of criminal activity in Suffolk, England found that both criminal residence and criminal activity were neither congruent nor random. It was found that a greater proportion of criminals (n= 228) resided in the villages (83%) of Suffolk rather than the towns (17%) yet the crime site locations were for the most part located in the towns. Glyde found this discrepancy surprising; that the criminals, for the most part, were not targeting the areas in which they resided. Yet it follows the propositions of Burgess (1925) in that a town (synonymous to a city at that time) presents more opportunity with greater numbers of persons and
businesses and concomitant criminal opportunity. The towns in Suffolk were in all probability more suitable for criminal activity as they harboured a larger selection of targets and offered more anonymity. Additionally, it may have been the case that criminally inclined individuals ventured into the towns to shop or engage in necessary routine activities and found numerous tempting opportunities worth returning to and targeting.

MacDonald and Gifford (1989) and Rhodes and Conly (1981, chap. 9) both evaluate elements of Pattern Theory and offer strong support for the reliability of certain propositions. MacDonald and Gifford (1989) assess the cognitive process involved within crime site selection for burglars targeting single-family dwellings. Specifically, the researchers looked at whether or not burglars perceive targets in the predicted holistic fashion (Brantingham and Brantingham, 1978b) or whether they assess individual characteristics of a target in choosing a home to burgle. Forty-four convicted burglars were interviewed and assessed numerous pictures of fifty homes based on a continuum of 'highly representative' to 'not very representative' in terms of the probability that the home would potentially be burgled. The results indicated that within the cognitive decision-making process of selecting a target, burglars do not consider individual level cues, such as whether a home has a solid front door or plastic windowpanes. Rather, the target suitability of the homes was perceived holistically or categorically in terms of the following: road surveillability, occupant surveillability, symbolic barriers and physical barriers (MacDonald and Gifford, 1989). A negative relationship appeared between the extent to which a home
was perceived as visible from the road and inside by the occupants and the probability of the burglar targeting it. A surprising positive relationship was found between the category of symbolic barriers and the likelihood of target selection. This category represented factors such as a well-groomed lawn or garden and was speculated to infer a high likelihood of valuable items being found. Thus, the study confirmed Brantingham and Brantingham's (1978b) theory that offenders perceive targets holistically rather than in a piece-meal fashion.

Rhodes and Conly (1981, chap. 9) assess the relationship between crime templates and the spatial distribution of crime sites. The study defined an area encompassing 'target attractiveness' as one that inhabited desirable targets, yet more importantly was attractive to the offender due to a lower detection risk. At the same time, an area representing 'spatial attractiveness' was seen as an urban area that was familiar and close to the offender's activity nodes. 'Surrounding areas' were those situated several blocks away from the offender's residence but close enough to be traversed regularly. In looking at rape, robbery and burglary, Rhodes and Conly wanted to know how far offenders would travel to crime sites depending on the characteristics of the neighbourhoods in which they resided. The data were obtained from an offender database (PROMIS) from the District of Columbia. In general, the results support the assertion of Pattern Theory that criminals will offend within their awareness space and close to primary activity nodes rather than travel farther to access more desirable targets; which seemingly confirms the pervasiveness of a crime template. The findings demonstrate that robbers (n= 832) on average travelled 2.10 miles (3.36 km)
from their home to commit crimes and that burglars (n= 796) and rapists (430) travelled 1.62 (2.5) and 1.15 (1.84) miles (km) from home, respectively, to commit their crimes. The distance travelled to the crime site varied depending on the immediate surroundings from which the offender resided and how conducive such surroundings were to the criminal activity in question. If the neighbourhood contained a high proportion of family, multiple family and small business dwellings, the offenders travelled farther than if the area was transitional in nature (e.g., temporary housing, construction, demolition). This was explained by pointing out that a neighbourhood containing numerous dwelling units is more private in nature and not a likely part of an offender's spatial template of suitable crime site locations as the probability of detection is high. Industrial areas exhibit spatial attractiveness favourable to criminal activity as they are busy areas by nature with high traffic zones, leading to anonymity and efficient escape routes (MacDonald and Gifford, 1989). The criminals residing in the industrial areas travelled the shortest distances to the crime sites.

The study clearly shows that an offender's physical environment affects the spatial distribution of crime sites and mediates the relationship between an offender's target preference and target selection; if the geographic surroundings are not propitious to criminal activity, the offender will travel further to locate a target despite how attractive a proximally closer target may be. This supports Pattern Theory's proposition that crime site selection is a function of both the crime template of the offender and his surroundings and as such interact bi-directionally in the decision-making process.
Cromwell, Olson and Avery (1991) conducted an ethnographic analysis of burglars and gained insight into the decision-making processes used by burglars in target selection. The study demonstrated that environmental cues can become part of a crime template and remain salient in the decision of whether to commit the crime in question. The study included thirty active burglars in Texas and utilized a 'staged activity analysis' method which comprised both interviews and ride-a-longs with the burglars. The method allowed for comparison between the recollections of the burglars when recalling their decisions to break and enter a home or not, and observations made by the researchers during the ride-a-longs. During the ride-a-longs, the burglars were asked to select two sites previously targeted and also others that were perceived as being “high risk” (i.e., likely to be targeted at that moment) or “low risk” (i.e., unlikely to be targeted at that moment) and rate them on a 10 point scale; 0 representing ‘would not do it’ and 10 representing ‘would do it right now’.

It was revealed that the burglars assumed that all potential homes contained something of value, thus the decision of whether to break in or not was not initially based on whether the house contained valuable goods, but gauging the risk level involved based on three primary factors reflective of an Environmental Criminology framework: surveillability, occupancy and accessibility (Cromwell, Olson and Avery, 1991). These risk factors were considered sequentially by the burglars; first they would assess how observable the house was by neighbours and passers-by (e.g., can the neighbours see into the yard from their window or are there any shrubs obstructing neighbours view
of the yard?), second they would attempt to determine whether the house was occupied at the time (e.g., are there lights on or cars in the driveway?) and lastly the level of accessibility was considered (e.g., how easy or difficult is it to break in; are there locks on the door, alarms or a dog inside?). Cromwell et al. (1991) termed this the “three component decision making strategy” and held that it was predicated on an argument by contradiction. By this, it was explained that the burglars would begin their assessment of the environment by assuming that all three measures of risk were present and that the situation was not conducive to the successful commission of the burglary (i.e., “someone will see me”, “someone is home”, and “it is too difficult to gain entry”). From that point, the burglar engages in a search of that specific environment for cues allowing him or her to negate those assumptions leading to a contradiction of their initial reservations and the subsequent commission of the burglary.

The findings from Cromwell, Olson and Avery’s (1991) ethnographic study of burglary is insightful on two accounts. First, it is interesting that the decision not to burgle a house was made quicker and was far more easy than the opposite decision of committing the crime. In order for the burglar to decide to commit the crime, all three parts of the three-component decision making strategy had to have been contradicted (surveillability, occupancy and accessibility), whereas in order for the burglar to abort the idea of committing the burglary, it only took the validation of one of those components. Thus, it was observed that the decision-making process of burglars erred on the conservative side, argued by Cromwell et al. (1991) as one of personal safety. Secondly, the
study showed how environmental cues are a pervasive part of the criminal event equation, at a micro level of analysis. Once the area and specific house was selected, the burglars engaged in a search of the surrounding environment to gauge whether the target was appropriate and thus whether the circumstances were conducive to the successful commission of the burglary. This supports the theory of crime site selection held by Brantingham and Brantingham (1978b, 1984). Brantingham and Brantingham (1984) hold that the target selection process begins with 'mixed scanning' whereby the offender starts to search for parts of a city encompassing attractive targets and eventually narrows down to a specific street or home. It is explained that not all potential targets are equally likely to be selected as they vary in their cue-emitting potential. Cromwell et al. demonstrated that burglars do, in fact, recognize that certain homes embody characteristics that make them more likely to be targeted than others such as those with backyard fences and sliding balcony doors. Subsequently, there existed a bi-directional relationship between environmental cues and the burglar’s perception of potential targets; homes under consideration were said to emit varying levels of risk in terms of the environmental cues of surveillability, occupancy and accessibility and it is from such cues that the burglars based their decisions on whether the potential gains outweighed the perceived level of risk.

Many studies have supported Pattern Theory’s proposition that the spatial distribution of crime is disproportionate within certain areas and close to the offender’s activity nodes (Wiles and Costello, 2000; Rand, 1986; Sherman, Gartin and Buerger, 1989; White, 1990). Wiles and Costello (2000) in the Home
Office paper, "The Road to Nowhere" strongly supports this proposition. The study assessed police recorded burglary data for the city of Sheffield and the North part of Yorkshire and found that the average journey from the offender’s residence to the crime site was 1.88 miles (3.0 km) in Sheffield and 0.98 miles (1.57 km) for the North Yorkshire (n= 5695) region. Most interestingly, the study found additional patterns drawn from police records in Sheffield with interviews of convicted burglars (n= 70). Wiles and Costello found that the original short burglary trips gleaned from the police records were actual overestimations according to the offenders themselves. The average distances decreased from 1.8 miles (3.0 km) to 1.6 miles (2.56 km) after the burglars, via interviews, indicated that many crime trips originated from points closer to the target than their homes. As is often the case, the offender’s residence was the point of origin from which the study conducted its spatial analysis, yet the burglars stated that many of their journeys to crime originated from alternate locations such as a girlfriend’s home or a friend’s residence, which was actually located closer to the target.

White (1990) explored the relationship between neighbourhood permeability and the burglary rate. ‘Permeability’ was defined as the number of access streets from traffic arteries to neighbourhoods and was calculated as the rate of the number of access lanes per one thousand households. It was hypothesized that highly permeable neighbourhoods would experience higher burglary rates based on propositions found in the field of Environmental Criminology where major travel arteries bring together persons from varying
backgrounds and frequented activity spaces of individuals. In a regression analysis controlling for neighbourhood economic status, instability and housing density, White found that 'permeability' accounted for 31% of the variation in the burglary rate inferring support towards the hypothesis. Additionally, the variable of permeability was statistically interacted with differing demographic variables of other neighbourhoods and maintained the same level of significance in a regression analysis of burglary rates; showing that permeability had a uniform effect across various neighbourhoods. White speculated that since permeable neighbourhoods are situated between highly travelled paths and traffic arteries and thus are highly accessible to motivated offenders, they are spatially attractive. As routinely travelled paths and traffic routes are highly likely to fall within an offender's awareness space, they are probable components of a crime template.

The propositions of both Routine Activities and Pattern Theory have been empirically supported across differing crime types, including robbery. Block and Davis (1996) found that street robberies disproportionately occur close to rapid transit stations and van Koppen and Jansen (1998) demonstrate that that 58% of convicted robbers offended less than 6km from their homes. Block and Davis assessed the instances of street robbery in four Chicago police districts for 1993 and 1994. Half the districts were considered 'high crime' areas in terms of the overall crime rate and the other half were considered 'low crime' areas. For the higher crime district, two out of five transit stations were associated with disproportionate numbers of street robberies while every transit station was a hot
spot for this offence in the lower crime area. The high crime area, by definition, experienced greater overall crime occurrence spatially such that it was difficult to ascertain any specific pattern between the existence of a rapid transit station and criminal activity. Yet, in looking at the spatial distribution of the stations in relation to street robbery occurrence, the threat of street robbery appeared more spatially diffused throughout the areas categorized as high versus low crime. The study explains such findings in that it may not be the presence of rapid transit stations propelling the street robbery rate in high crime districts; rather the intensity of street usage in general, potentially accounting for more overall crime, spatially. However, in the districts categorized as 'low crime', the rapid transit stations evidenced as hot spots for street robbery potentially supporting Routine Activities’ postulation of an increase in the probability of predatory crime occurrence in areas intersecting offenders and victims. Block and Davis’ study cannot infer that the existence of rapid transit stations ‘causes’ street robbery to ensue; however, it strongly suggests that criminal activity disproportionately occurs in areas exhibiting activity nodes where offenders and victims are likely to intersect and as such confirms the study’s initial hypotheses. Such results lend strong support for explanations of criminal events found in both Routine Activities and Pattern Theory.

On a similar trajectory, van Koppen and Jansen’s (1998) research on the spatial patterns of convicted robbers in the Netherlands for the year of 1992 lends strong support towards Pattern Theory, specifically the salience of a crime template. The study found that the extent to which robbers (total n= 585 robbers
and 434 robberies) prepared in advance for the crime did not affect the average distance travelled to the crime site. For example, when comparing groups of robbers who claimed to have planned their crimes (n= 274) versus those who were more impetuous (n= 242), 58% of the ‘planned’ robbers offended only 6 km from their homes and 54% of the more spontaneous robbers offended within the vicinity of their residences. Thus, the spatial pattern of remaining within one’s awareness space to commit crimes seems to hold constant even when analysing ‘professional’ criminals, if one infers that planning connotes criminal professionalism. It was also hypothesized that as the number of successful robberies an offender commits increased, so would the distance with which he would travel to a crime site. However, it was found that out of 127 robbers convicted of more than one robbery, the majority travelled either the same (15%) or smaller distances (42%) to each consecutive crime site. Such a finding can be explained by the existence of a crime template (Brantingham and Brantingham, 1978b, 1984). The robber most likely formulates a representation of what constitutes an attractive target and upon the successful commission of a robbery, that representation becomes reinforced. Due to the fact that the initial robbery was highly likely to occur within the offender’s awareness space, consecutive robberies would likely be conducted in a similar manner and in a similar area.

Lastly, it is imperative to note that van Koppen and Jansen’s (1998) study also substantiates Brantingham and Brantingham’s (1978b) crime site selection theory. The study estimated the individual range of operation for the robbers by converting the length of each trip to a percentage of the robber’s total range
while ignoring the longest trip. It was found that for each robbery (n=283), the spatial patterns of the crime sites were random if located within the offender's awareness space: “robberies of each robber are dispersed almost randomly within each individual range of operation” (van Koppen and Jansen, p. 243). The robbers may have encompassed a non-uniform awareness space and a uniform target template. In such cases, they are likely to select targets close to primary activity nodes such as residences. Here, the spatial distribution of crime sites may appear random; a reflection of imprudence on the part of the offender as being discriminatory within target selection is not a priority and would be reflected spatially.

Serial rapists show similar spatial patterns of offending. Warren, Reboussin, Hazelwood, Cummings, Gibbs and Trumbetta (1998) and Alston (1994) both found that rapists' victim selection patterns were not random but predictable. Warren et al. (1998) found that serial rapists (n=108) travel an average of 3.14 miles (5.0 km) in search of a victim and Alston (1994) concomitantly found that 58% and 97% of serial sexual assaults series occurred within 2.5 km and 3.5 km of a rapist's primary activity nodes and routine pathways respectively (n=29 sexual assault series constituting 102 stranger rapes). Almost half of the sexual offenders in Warren et al.'s sample raped at least once within 0.5 miles (0.8 km) of their home. The same study offers strong support for the buffer zone and the distance-decay phenomena (Brantingham and Brantingham, 1981). A small percentage (8%) of incidents occurred within or immediately surrounding the offender's residence whereas 13% of rapes took
place in the second distance interval. Thus, the desire of the offender to avoid recognition appeared more important than targeting a victim within direct proximity to their residential activity node. Also, as the radial distance increased from the offender's residence, the proportion of incidents concurrently decreased, illustrating the distance-decay effect.

Warren et al. (1998) utilized a spatial analysis technique termed the convex hull polygon technique where a visual boundary is established around the outermost crime site points in each case such that all crime site locations are included in the polygon. It is then assessed whether the offender's residence is located within or outside of the visual boundary. It was shown that rapists who resided within the convex hull polygon traveled an average of 23.5 miles (37.6 km) squared whereas those living outside of the polygon traveled an average of only 4.5 miles (7.2 km) squared in their target selection processes. Thus, those rapists whose targets lay within the area encompassing their residence traveled much farther than the rapists whose targets were located outside of the area in which they lived. Interestingly, these results were dichotomized by the offender's temporal preference. Rapist's (n=11) who offended during the daytime selected victims whom were significantly farther outside of their calculated individual ranges than those who preferred to offend during the nighttime hours (n=65), who selected victims within the convex hull polygon. These results may be reflective of the higher risk of detection that an offender faces during daylight hours. If a criminal prefers daytime hours to offend, he may be more likely to travel outside of his awareness space to maximize the chances of escaping.
detection from wary neighbors who arguably are more likely to see the individual approaching a target during the daytime. Conversely, if the offender prefers nighttime hours to engage in the criminal activity, he, by the very nature of it being dark, potentially decreases the likelihood of detection and may thus interpret traveling distances away from the activity space unnecessary when selecting victims. Alternatively, this pattern may be reflective of the location of women (as targets) during the day (e.g., at work or in major shopping centers) as opposed to at night (e.g., at home or in bars/lounges). Thus, depending on the time preference of the rapist, the target selection process would have differed with the spatial distribution of female victims within a city as a function of temporal factors.

Moreover, the spatial findings within the convex hull polygon analysis may be indicative of other patterns. First, as predicted by Brantingham and Brantingham (1991) an offender whose victim template is uniform in nature may select randomly and thus would most likely offend close to home within their awareness space, as why would one expend more energy and effort than necessary? Conversely, Brantingham and Brantingham explain that if the victim template is non-uniform in nature and entails specificities, the offender may be willing to travel greater distances in order to fulfill the desire of selecting a certain type of target. Thus, it may be the case that the rapists in Warren et al.'s (1998) study who lived inside the convex hull were selecting randomly within their awareness space, as their preferred victim was uniformly available and non-specific. The rapists residing outside of the convex hull polygon area may have
been in search of a non-uniform victim and once located, narrowed his search to a specific and finite location; potentially explaining the minimal average distances traveled (4.5 miles; 7.2 km) to the crime sites. Second, the convex hull polygon results may also reflect the fact that rapists who select victims in the area around their home have a more detailed level of knowledge of a larger area as opposed to rapists who commute to unknown areas in order to select targets. The larger distances covered by the rapists offending within the convex hull polygon may be exhibiting a general comfort level within the area and the ability to move about freely, traveling greater distances yet remaining within a part of the city connoting an awareness space. A rapist living outside of the area in which he is offending may be less familiar in such surroundings and thus less comfortable to move about and travel greater distances within that area.

In evaluating the spatial patterns of serial rapists in the Lower Mainland of British Columbia, Alston (1994) noted that the initial contact scenes between the offender and victim were consistently located in close proximity to the rapist's activity nodes and routine pathways (n= 102 stranger rapes). Specifically, 58% of the rapes occurred within 2.5 km of a primary activity node of the offender. In addition, 97% of the serial rapists selected victims within 3.5 km of a routine pathway located within the probable awareness space of the offender (Alston, 1994).

The research done under the umbrella of Environmental Criminology has thus far, exhibited the ability to confirm hypotheses concerning the spatial distribution of crime sites within a city and regarding the nature of crime site
selection processes. Alston’s (1994) study is a superlative example of empirical research where the propositions of Environmental Criminology are utilized to predict the vicinity within which a serial offender may be residing. Alston (1994) utilized the Criminal Geographic Target (CGT) (Rossmo, 1994) technique in order to assess the predictability of the spatial patterns observed for two prominent serial rape series in British Columbia, the Oughton and Olson cases. As such, the study tests the validity of the propositions within the theories of Environmental Criminology to the extent they represent elements of the criminal event equation. Developed from the tenets of Environmental Criminology, CGT analyses the spatial information associated with a series of linked crimes and attempts to discern the most probable areas in which the offender’s residence or other primary activity nodes might be located. Pattern Theory has shown that one can predict the crime site selection patterns of a criminal if his residence is known and CGT explores whether the reverse is equally predictable; if one knows the locations of a series of criminal events suspected to be committed by one serial offender, can the residential area of that offender be identified? Regarding the Oughton series, Alston found that when looking at the initial contact scene locations collectively, CGT predicted the vicinity of the rapist’s activity node locations successfully. The Olson series did not produce as sound results as the offender changed residences numerous times, expanding his awareness space vastly. Due to the fact that the CGT analysis was conducted ex-post facto, Alston was able to refer to the case files of the rapists to confirm that the area specified in the profile was in fact the area encompassing the
offender’s residential primary activity node. Thus, the data were accurately corroborated and the tenets of Pattern Theory were shown to be predictive in nature when reversed.

Canter and Larkin (1993) assessed the spatial activity patterns of forty-five British sexual offenders convicted of two or more stranger rapes. The study attempted to explore the psychological aspect of offender spatial activity patterns at an individual level as opposed to looking at aggregate geographical offender behaviours. In doing so, the criminal range of the rapists was explored based on two models. The marauder model holds that a primary activity node such as the offender’s residence will serve as a base from which they select targets and that the criminal range area will overlap with the home range of the offender. The commuter model holds that the area encompassing the crime sites is independent of the home range of the offender. In other words, there is no geographical overlap between where the offender lives and where he or she selects targets. To test these two models, Canter and Larkin used the convicted rapist’s residential location as the base from which distance was measured to each crime site. Specifically, the circle hypothesis was implemented by drawing a straight line between two crime site locations furthest from one another and treating that line as the diameter of the circle; a by-product of circular geometry. From this process, the researchers were able to ascertain both whether the offence locations and the rapist’s residence were located within this circle. If such a pattern were found, the marauder model would be applied to the rapist’s spatial activity. Additionally, the range hypothesis was utilized, which compared
the distances between the crime site locations themselves and those locations in relation to the offender’s residence.

The rapists in Canter and Larkin’s (1993) study travelled an average of 1.53 miles (2.44 km). It was also found that the rapists avoided the area 0.61 miles (0.98 km) from their home within the target selection process; this was termed the ‘safe area’. They found that 91% of the offenders had targeted victims within the circular region developed through the circle hypothesis test. When looking at the residential location, 87% of the rapist’s homes were located within the circle hypothesis prediction area. Thus, the circle hypothesis demonstrated the marauder model for the vast majority of the rapists in this study; the offenders favoured areas close to their homes when selecting victims. Additionally, a significant correlation ($r = 0.93$) was obtained for the distance between each crime site location and the same locations in relation to the residence of the offender. Thus, the distance the rapist travelled from home to select targets was significantly related to the distance between the crime site locations themselves. Canter and Larkin demonstrated that the serial rapists spatial activity patterns reflected that of the marauder model in that 87% of the offenders used their residential location as a base from which target selection ensued.

The unequal spatial distribution of criminal activity has been noted in numerous metropolitan cities. Sherman, Gartin and Buerger (1989) document the locations from which ‘calls to police’ were made by the public in Minneapolis during 1986. From the total number of calls received by the Minneapolis police
during that year (n= 323,979), Sherman et al. (1989) focused on the locations of calls for sexual misconduct, robbery and auto theft. The results found a spatial concentration with both overall calls and calls varying by crime type, indicating the existence of criminal ‘hot spots’. Specifically, over half of all the police calls were dispatched to only 3% of all possible addresses in the city of Minneapolis (n= 115,000 possible addresses). The police calls made for robbery; auto theft and sexual misconduct came from only 2%, 3% and approximately 1%, respectively, of all possible addresses in the city. Additionally, it was shown that the probability of an address being targeted significantly increased after the first criminal occurrence, demonstrating that the risk of victimization was not uniform for each address in the city; rather it was unevenly distributed both spatially and temporally. Furthermore, the ‘calls for police’ data revealed that the elevated risk experienced in hot spot areas was not uniform in nature. Sherman et al. note that within the high crime neighbourhoods, the majority of the addresses were crime free and that only a few hot spot addresses accounted for a disproportionate amount of the calls made to police within those areas.

Such findings inevitably led to a more in-depth enquiry attempting to identify what types of establishments constitute the hot spots identified in numerous studies of various metropolitan cities. Were these addresses residential, industrial or commercial in nature? Additionally, what is it about such establishments and perhaps their locations that render them ‘hot spots’ of criminal activity? Roncek and Maier (1991) conducted such an analysis for the city of Cleveland from 1979 to 1981 (see also Langworthy and LeBeau 1992a,
1992b). Specifically, the study assessed the average frequency of six index crimes (murder, rape, robbery, aggravated assault, grand theft and auto theft) as a function of the total number of bars and cocktail lounges on each city block (n=4,396 blocks). These commercial establishments were focused on because the study assumed a Routine Activities theoretical framework. The authors assumed that the presence of such establishments would attract large crowds and thus increase the probability of an offender and victim intersecting in the absence of a capable guardian. The results show, for every type of crime assessed, a significant positive correlation between the number of bars and lounges on a city block and the occurrence of criminal activity (Roncek and Maier, 1991). The presence of a bar or lounge on a city block increased the probability of a murder, rape, robbery, or grand/auto theft by 5%, 6%, 20% and 13% respectively. The incremental increase of all index crimes implied that each additional bar or lounge was associated with 2.3 more crimes per block per year than the block would have experienced otherwise, based on population and housing characteristics alone. Roncek and Maier argue that the results can be explained by Routine Activities Theory in that these establishments drew large crowds, concomitantly providing high levels of anonymity for criminally inclined individuals with decreased guardianship of potential victims. Such a combination was seen as inevitably producing circumstances that would be difficult for the public and law enforcement to monitor and control. Yet, such an explanation may be too simplistic in nature. It may be that the increased probability of crime on blocks with bars and lounges occurred not only as a by-product of increased crowds
alone, but also in part to the type of demographic characteristics found in such crowds attracted to these venues. Young persons, particularly males between the ages of nineteen and thirty mostly frequent such businesses and also are the demographic responsible for the majority of criminal activity reported to the police. Thus, the age group most often linked to criminal activity is also most likely to frequent the establishments associated with increased index crime occurrence in the study. Nonetheless, this article on the specificities of hot spots is invaluable as it provides insight into what types of establishments exhibit high rates of criminal activity (commercial) and why this is so (Routine Activities explanation).

In addition to police investigation use, the field of Environmental Criminology has raised issues with regard to situational crime prevention (Barr and Pease, 1990). Barr and Pease (1990) present such issues by reiterating that the techniques and resources allocated to crime prevention and public safety will vary as a function of covertly held beliefs about the disproportionate distribution of criminal activity. The phenomenon of ‘displacement’ is extensively discussed and defined as the movement of crime to a different area from a previously high crime area due to the implementation of crime prevention strategies (Barr and Pease, 1990). In light of the research in Environmental Criminology identifying the uneven spatial distribution of criminal activity, Barr and Pease raise the question as to whether society would be willing to support a crime prevention strategy whose end goal would result in a more equitable dispersion of criminal activity through a city, as the eradication of crime all
together is both idealistic and unlikely. As such, the dilemma is presented as to which scenario is more favourable; high peaks of vulnerability for a select few areas surrounded by areas with comparatively low levels of vulnerability, or a more uniform dispersion of criminal susceptibility for all? The justification for such a question lies in ensuring the efficient distribution of police resources, according to Barr and Pease. If total elimination, resulting in ‘no crime’, is the goal of society, then crime prevention measures should be implemented in a spatially equal manner. If a uniform distribution of crime is sought, crime control measures ought to be concentrated on areas suffering from the most amount of crime in order to disperse the criminal activities more equally. However, if the maintenance of crime hotspots is desired in order to ensure that criminal activity is segregated to only certain areas, police protection ought to focus on those not yet targeted, as criminally active areas are to remain as such. Barr and Pease argue that crime control strategies should strive towards a policy of crime deflection where a uniform distribution of criminal activity ought to be borne by all in society; why should a small proportion of the population bear the burden of residing in areas exhibiting the majority of criminal activity?

**Arson and Environmental Criminology Research**

As opposed to murder, sexual assault and property crimes such as burglary, the crime of arson is underrepresented in empirical research from an Environmental Criminology perspective. The vast majority of literature discussing arson focuses on the etiology of pyromania and/or additional motivations for the crime stemming from monetary reward to revenge (Kocsis,
and Cooksey, 2002; Barnett, Richter, and Rennenberg, 1999; Brady, 1988; Rasanen, Hirvenoja, Hakko and Vaisanen, 1995). According to the Canadian Criminal Code, the crime of arson is a federally indictable offense in which a person "intentionally or recklessly causes damage by fire or explosion to property" (Criminal Code of Canada, December 31, 2002). It is the argument of the researcher that examining this crime from an Environmental Criminology perspective is beneficial in aiding the understanding of why arsons occur in certain areas and what types of structures are targeted. As is characteristic of many crimes, arson does not often occur randomly (Rogerson and Sun, 2001). It exhibits spatial and temporal patterns, which, if researched further, may increase our understanding of this crime empirically and also aid Law Enforcement agencies in their investigations. This paper will discuss the few studies examining arson from an Environmental Criminology perspective in order to illustrate the utility of viewing this crime through such a lens.

Rogerson and Sun (2001) spatially analysed arson data from the Buffalo, New York Police Department for the year of 1996. Data were retrieved from the Buffalo, NY Police Department for 1996 where 379 arson locations were mapped. Out of the total number of arsons, the first 200 established a baseline value of spatial distribution that indicated clustering in certain areas. Rogerson and Sun did not shed light on the characteristics of the areas where such clusters occurred, however it was noted that they might have occurred where population density was high, increasing the probability of criminal activity due to sheer numbers. It was found that the clustered distribution of arsons began to reach
significance after the addition of 80 arsons to the original 200. Lastly, following a cluster signal, subsequent arsons began to follow a uniform pattern of spatial distribution, and thus were widely spread out. The authors hypothesized that this may have been due to an increase in police presence after a string of arsons were identified in a specific area. An additional explanation may be that the uniformity following a clustered pattern could be indicative of the nature of the crime. When a target is burned, it is ultimately ruined, thus if much arson occurs in one area, there may be very few targets left to choose from or little left of an original target to re-burn. It must be noted that Rogerson and Sun’s (2001) study does not offer any insight into why the arsons were occurring and does not indicate any change in the volume of the crime.

Bennett, Merlo and Leiker (1987) conducted a spatial analysis of arson patterns for Springfield, MA between 1980 and 1984. The term ‘incendiary’ fire was used in reference to deliberately set fires, which is the terminology used by fire departments. The study included 440 incendiary fires and 732 accidental fires. For the purpose of this thesis, only the results regarding the incendiary fires will be discussed. Bennett et al. (1987) utilized two types of spatial displays in the analysis of arson: dot maps and choropleth maps. Dot maps are used to display individual address level data; in this case the locations of the arsons. Dot maps show spatial patterns clearly and are simplistic to analyze visually, however the researchers reiterate that they are not always conducive to running spatial statistics. Choropleth maps, however, are friendly to the use of spatial
statistics in examining the underlying causes of spatial variance (Bennett et al., 1987). They are areal-based maps used to display aggregate data.

The dot maps showed that there was a major cluster of arson located in the northwestern part of Springfield where the central business district was located. In this area, a lot of commercial activity took place as well as high percentages of multi-family residences. The choropleth maps also confirmed a concentration of arsons in the northwestern part of the city; however, it also showed a smaller distribution of arsons in the northeastern part of the city (Bennett et al., 1987). In this part of Springfield, major travel arteries were located and surrounded by establishments attracting large crowds such as shopping malls and fast food restaurants.

In the multiple regression analysis, Bennett et al. (1987) used ‘arson occurrence’ as the dependent variable and examined thirteen various independent variables that were reflective of socio-demographic characteristics of populations and property at the census tract level in Springfield, MA. The strongest correlations to arson occurrence were found with the variables of ‘vacancy’ (r = .787), ‘poverty’ (r = .687) and ‘tenements’ or housing structures with 5 or more units in them (r = .669). In a stepwise regression, it was shown that the two variables of ‘vacancy’ and ‘tenements’ alone accounted for 70% of the variance in arson occurrence in Springfield, MA.

Pettiway (1988) investigated the rate of arson incidence between ghetto and non-ghetto environments in relation to urban spatial structure. This study was based in Houston, Texas in 1980. A ‘ghetto area’ consisted of areas in
which black populations accounted for a minimum of 30% of the total population; however, in the final study almost 67% of ghetto areas were comprised of 75% black persons. A 'non-ghetto' area was defined as an area where less than 30% of the total population was black. Pettiway found significant differences between group means for social and structural variables related to arson rates between ghetto and non-ghetto areas; specifically, in regard to age, family dissolution, residential stability, economic position, land use, structural density, and structural inadequacy. Ghetto areas had high percentages of black populations whereas the non-ghetto areas consisted of other minorities, older populations and larger number of external migrants from outside of Texas. Interestingly, the variable most related to the arson rate was the 'age of housing'. The variables were positively related in that areas with higher percentages of older housing also had higher arson rates. Pettiway explained that this relationship may be mediated within the relationship between income level and arson rates. Individuals who cannot afford good quality housing are forced to reside in areas comprised of older buildings and vacant residences, both of which are strongly related to the opportunity for arson. Lastly, Pettiway hypothesized that there may exist a relationship between structural density and arson rates. It is believed that increased structural density may indicate urbanization, which leads to increased competition for land close to the city center. Such land usually increases in value thereby driving the value of outlying properties down. The decrease in the value of the outlying property increases the risk for arson. Property that is low in value is less likely to be maintained well and concomitantly more likely to be
abandoned, increasing the probability of arson occurrence. In general, Pettiway's study indicates that in Houston, Texas, areas evidencing high arson rates are comprised of older housing, vacated premises and lower-income, black populations.

Stahura and Hollinger (1988) investigated the arson rates of 676 suburban U.S. cities in relation to variables representing a Routine Activities perspective. This study is interesting as it focused on an area that is not commonly analyzed with respect to arson: the suburbs. Stahura and Hollinger reiterated that based on Uniform Crime Reports, violent and property crime rates have increased significantly more in suburban areas in comparison to increases seen in criminal activity for central city regions.

The independent variables examined in relation to suburban arson rates for 1980 were the following: 'criminal motivation' (i.e. unemployment), 'criminal opportunity' (i.e. older housing), 'guardianship' (i.e. police presence) and 'ecological niche' (i.e. median house value). The assumptions were that motivated offenders and criminal opportunity would be positively related to suburban arson rates and that guardianship would negatively affect such rates. Also, it was hypothesized that criminal opportunity would be related to the concentration of motivated offenders and that upper class or exclusive suburbs would have the lowest arson rates.

The results indicated that out of the four independent variables, 'criminal motivation' was the most highly predictive of suburban arson rates. 'Guardianship' had a positive effect on arson rates and thus yielded a
relationship opposite to the one hypothesized by Stahura and Hollinger (1988). One explanation for this finding was that if guardianship is interpreted as representing police presence, then increased rates of crime may necessitate increased police patrol, which would account for the positive relationship between these two variables. Lastly, a mediated relationship was identified between the opportunity for arson and the arson rate. Stahura and Hollinger found that 'opportunity' itself was not strongly related to the arson rate, however when coupled with 'motivated offenders', the relationship to the arson rate increased in significance. Thus, in the absence of criminally inclined individuals, criminal opportunity itself may not be sufficient to positively affect crime rates.

What is not included in this study is a comparison of the factors affecting variance in suburban arson rates to those affecting urban arson rates. Such findings may lend insight into additional structural and demographic relationships to arson that could potentially be used in crime prevention strategies. For example, if it is found that 'older housing structures' is an equally salient variable in both urban and suburban arson rates, city planners may want to invest in upgrading the value of those structures and/or increase police presence in such areas.

Attempting to discern if a distinction exists between arsons set for instrumental purposes and those expressive in nature, Canter and Fritzon (1998) conducted a content analysis of 175 solved arson cases from across England. The researchers were interested in whether a relationship existed between the characteristics of the arson offense and the characteristics of the offender. An
expressive crime was defined as one where the cause originates from within the offender him or her self such as anger or attention seeking; whereas, the instrumental crime embodies a more direct, tactical cause, purposive and external in nature such as revenge or profit. Canter and Fritzon developed four modes of arson behavior based on the arsonist’s motivations and the targets: ‘expressive person’ entailed arsons attempting to restore emotional equilibrium or alleviate distress, ‘instrumental person’ was an arsonist who set fires due to a dispute or external event and sought retribution, ‘expressive object’ entailed those with an intrinsic fascination with fire leading to the arson behavior and ‘instrumental object’ reflected fire setting behavior committed by groups of mostly young persons that was opportunistic in nature, or arson for profit cases. The results indicated that serial arson behavior was most strongly associated with the expressive object mode \( r = 0.56, p < .001 \) and negatively related to the instrumental person mode \( r = -.34, p < .001 \). Thus, serial arsonists were less likely to target specific people and more likely to encompass an intrinsic fascination with fire. The study demonstrated that the relationship between the characteristics of an arson offense and those of the arsonist him or her self can be systematically studied and measured and can reveal statistically significant associations; the way in which the crime of arson is carried out is related to the motivation of the crime itself.

The National Center for the Analysis of Violent Crime in conjunction with the Federal Bureau of Investigation Academy, published “Essential Findings from a Study of Serial Arsonists” (Sapp, Huff, Gary, l'cove and Horbert, 1998) in which
83 convicted serial arsonists setting a total of 2,611 fires were assessed to identify attributes, characteristics, motives and offending patterns for criminal investigative information and use. Interviews and case file analyses were conducted with the arsonists who were from both the Eastern and Western United States. Upon analyzing the distances traveled to the crime scene from the offender’s residence, Sapp et al. (1998) found that 50% of the serial arsonists traveled 1 mile (1.6 km) or less to set their fires. Specifically, 29.7% traveled \( \frac{1}{2} \) to 1 mile (0.8 to 1.6 km) from home to light fires and 20.3% traveled 1 to 2 miles (1.6- 3.2 km). Only 2.7% of the cases involved targets within 1 block of the offender’s residence, whereas 12.2% were located within 2 to 5 blocks from the home. Thus, for these serial arsonists, the area immediately surrounding or adjacent to their home base was actively avoided in the target selection process demonstrating the buffer zone phenomenon (Brantingham and Brantingham, 1981; Rossmo, 1995). A clear distance-decay pattern was revealed as the proportion of arsons committed decreased as the distance from the offender’s home increased. For example, 50% of the arsons were located between \( \frac{1}{2} \) a mile (0.8 km) and 2 miles (3.2 km) from the residential location, however only 4.1% of the arsons occurred within the 2 to 5 mile (3.2- 8 km) distance interval. It is interesting to note that 70% of the serial arson cases exhibited targets within a radius of 2 miles (3.2 km) or less from the offender’s residence.

The average age of the arsonists was 15 years and ranged from 4 years to 41 years. When asked why they deliberately set fires, 64% said it was for revenge, 26.5% claimed it excited them, 23% related their behavior to emotional
problems, 12% said it was for profit, 9.6% for vandalism and 4.8% set a fire to conceal another crime\(^1\). In looking at the level of preparedness, 46.2% said their arsons were premeditated, 35.9% were impulsive, 12.8% were opportunistic and 5.1% claimed to be more than one category.

The vast majority of the arsonists claimed they were familiar with the area(s) they targeted (95%). Despite these admissions, Sapp et al. (1998) stated, “no particular discernible pattern of target selection was found” (p. 57). The study utilized eleven categories representing the variable of ‘method of target selection’ and in doing so may have overlooked salient patterns. The categories of ‘knew the people’, ‘worked there’, ‘random selection’, ‘walking distance’, ‘convenience’, and ‘lived there’ may arguably be considered categorical variables representing the awareness space of the arsonists. When combined, these categories reveal that 47.6% of the serial arsonists chose targets in areas where they lived, knew the people or were able to walk to. These cases may also have involved a uniform target template on the part of an expressive arsonist as 23.5% involved random selection and targets within walking distance of a primary activity node of the offender. Other cases indicate a high probability of a non-uniform target template within an instrumental arson. Cumulatively, the categories (within the variable of ‘method of target selection’) of ‘knowledge of a target’, ‘for profit’, ‘for minimal damage’ and ‘for best results’ represented 20.6% of the arson cases. These results suggest a dichotomy within the sample between those who chose targets based on a uniform template that was widely available spatially and those who may have traveled farther to

\(^1\) Respondents were able to select more than one answer resulting in totals above 100%.
gain access to specific target exhibiting a non-uniform template. Unfortunately, the study did not assess the interaction between 'method of target selection' and 'distance traveled to crime scene', however, the following study explores such relationships.

It is the opinion of the researcher that this final study on arson represents a seminal piece of work examining the relationship between offender characteristics and the spatial activity patterns of the criminal event. Fritzon (2001) examined the relationship between distance traveled to the crime scene and motivational aspects of firesetting behavior. The study involved 156 solved arson cases in England, and contained both single cases of arson and serial arsonists. Each case receiving a score indicating the number of variables present for each of four behavioral themes: 'despair', an expressive arson directed at a person; 'display', an expressive category directed at an object and linked to attention seeking; 'damage', arsonists targeting properties mostly for profit, and 'destroy', arson as a planned attack against a specific person and may be retributive in nature. Fritzon viewed the behavioral themes of despair and display as reflective of behaviors indicative of expressive arsons. The themes of damage and destroy were viewed as representative of instrumental arsons in that specific targets are sought after and the goal purposive in nature. The variable of 'distance traveled' was measured from the offender's home.

The average distance traveled from residence to crime scene for all arsonists in the study was 2.06 km. The arsonists exhibiting behavior categorized as damage traveled an average of 2.11 km from their home to the
crime scene whereas the display arsonists only traveled an average of 0.54 km. The arsonists demonstrating destroy type behavior traveled an average of 6.24 km, the farthest distance traveled in the sample. Lastly, the despair arsonists remained close to home, only traveled an average of 0.56 km to set their fires. When dichotomized into expressive vs. instrumental arsons, the expressive arsonists traveled an average of 1.57 km whereas the instrumental arsonists traveled 1.91 km on average. Fritzon (2001) concludes that the despair and display arsons, being expressive, most likely reflected crimes with an internal origin and as such did not require the offender to travel as far in order to fulfill the goal of firesetting to relieve anger or gain attention. However, the damage arson is most likely purposive and tactical in nature, potentially requiring the arsonist to travel greater distances to access a specific area. Fritzon also explains that the destroy arsons, being a reaction to an external source of anger will evidence varying distances traveled depending on the location of the source of the anger. Yet, the damage and destroy arsons are arguably instrumental in nature encompassing specific target types; this may be a potential explanation for the larger average distances traveled. Nonetheless, the study showed that arsons motivated by internal processes tend to involve shorter distances traveled than arsons motivated by external sources.

Finally, it appears to be advantageous to examine the crime of arson from an Environmental Criminology perspective, which includes both spatial and socio-demographic analyses. This Chapter has reviewed research showing that criminal activity is often patterned and predictable in terms of location, timing and
target selection. While engaging in attempts to explain the etiology or motivation of criminal behavior may not yield reliable results, attempting to explain why certain areas are targeted more than others, does yield reliable and insightful conclusions. Obtaining information on the spatial distribution of arson and details on arsonist's target selection processes may aid fire and police department investigations by narrowing the radius within which a potential offender may be located. In addition, if consistent findings emerge as to what constitutes attractive arson targets, urban planning departments may be able to utilize such information to decrease the access to such targets and/or suggest ways in which to ensure the protection of them. Hence, examining crime from this perspective is invaluable and offers well-defined perspectives from which the present study was conducted. Chapter Three discusses the methods utilized to explore the spatial target selection processes of both single time and serial arsonists in the Greater Vancouver Region of British Columbia.
CHAPTER THREE: METHODS

The primary objective of this study was to assess the spatial target selection processes of arsonists in the Greater Vancouver Region of British Columbia. Specifically, the attribute of ‘distance traveled’ from resident location to crime site was examined. This was done through a comparative analysis of two criminal groups: the ‘single time arsonists’, who are defined as offenders charged with one arson and the ‘serial arsonists’, who are defined as having been charged with three or more arsons (Sapp et al., 1998). The crime type of arson was chosen in conjunction with the Geographic Profiling Unit of the Royal Canadian Mounted Police (RCMP) as it represented an area of criminal investigation that was in need of research.

**Exploratory Spatial Data Analysis (ESDA)**

ESDA is a method derived from Exploratory Data Analysis (EDA). EDA is a method whereby the researcher makes no assumptions about the population from which the data is drawn (Haining, 2003). Thus, often the analyses conducted are descriptive in nature as opposed to inferential; the goal is not to explain as much as to discern initially whether any pattern exists. ESDA is the spatial subset of EDA, exploring spatial data in various forms (Haining, 2003). The purpose of ESDA is to summarize spatial proponents of data, to detect spatial patterns and also to identify what constitutes representative or ‘average’
patterns and what is aberrant. This research study utilizes quantitative methods within the ESDA process. Additionally, as is indicative of ESDA, the techniques used in this research were primarily visual in the form of point pattern maps, buffer visualizations and various charts. The method of ESDA encourages 'data visualization' through examination of graphical views of data as part of an ongoing process to understand and gain insight into patterns that may be found within the spatial attributes explored (Haining, 2003). Thus, as the researcher explored the spatial data to assess any existing patterns in the target selection processes of arsonists and subsequently illustrated such findings visually, the method of this study is characterized as an ESDA.

Sample

The data for this research project is non-probabilistic in nature; specifically, the sample is purposive. The criterion for inclusion was the offender being charged with arson. There are no suspects in the research sample, only those who have been formally charged with arson by either the RCMP or Vancouver Police Department (VPD). Thus, specific arson cases in the Greater Vancouver, B.C. area were sought, and consequently pose certain limitations on the extent to which the results may be deemed representative of arson target selection processes. The results of this research project are generalizable to arson activity in the Greater Vancouver Region of British Columbia only.

The sample consists of charged arsonists from five jurisdictions across the Greater Vancouver area: Vancouver, North Vancouver, Maple Ridge, Coquitlam and Burnaby. Two jurisdictions outside of the Greater Vancouver area are also
included in the research project (Saanich and Penticton) as they exhibited serial arson cases that met the criterion for inclusion as well as occurring within the province of British Columbia. In general, the selection of the jurisdictions was based on the fact that they were the only municipalities exhibiting cases of arson in which the offender was charged for which the RCMP or VPD had both records of and access to. The time frame in which these arsons occurred ranged from 1990 to 2003. As mentioned previously, the arsonist sample is dichotomized into two groups: ‘single time arsonists’ and ‘serial arsonists’. For the single time arsonist sample, the data were obtained from two police databases, ‘PIRS’ from the RCMP and ‘PRIME’ from the VPD. For the serial arsonist sample, a content analysis of all the case files was conducted and these were accessed through the RCMP. During the data collection, four attributes were documented for descriptive analyses: distance traveled from residence to crime scene, the age of the arsonist, the sex of the arsonist and the target of the arson. Two addresses were documented for the spatial-statistical analysis of distance traveled: the arson location and the concomitant resident location of the offender at the time in which he or she was charged with arson.

With respect to the single time arsonist sample, the total number (N) of offenders charged with one arson = 46 with the total N of arson locations = 32 and the total N of concomitant resident locations of charged offenders = 46. Thus, the total N of location points spatially analyzed for the single time arsonist sample = 78. Table 1 displays the specific N of location points analyzed per jurisdiction for this sample as well as the totals for the sample as a whole. In
each jurisdiction, there was more than one person charged within one arson case, thus the number of charged arsonists exceeds the number of arson locations.

Table 1. Summary Table of Single Time Arsonist Sample.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Years Analysed</th>
<th>'N' of Charged Arsonists</th>
<th>'N' of Arson Locations</th>
<th>'N' of Resident Locations</th>
<th>Total 'N' of Location Points per Jurisdiction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vancouver</td>
<td>06/01-08/03</td>
<td>14</td>
<td>10</td>
<td>14</td>
<td>24</td>
</tr>
<tr>
<td>North Vancouver</td>
<td>02/98-11/02</td>
<td>10</td>
<td>8</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>Coquitlam</td>
<td>05/98-09/03</td>
<td>12</td>
<td>8</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Maple Ridge</td>
<td>09/97-08/03</td>
<td>10</td>
<td>6</td>
<td>10</td>
<td>16</td>
</tr>
</tbody>
</table>

Total 'N' of Arsonists for GVRD | Total 'N' of Arson Locations for GVRD | Total 'N' of Resident Locations for GVRD | Total 'N' of Location Points Analyzed in GVRD
--- | --- | --- | ---
46 | 32 | 46 | 78

Note, 'GVRD' represents 'Greater Vancouver Regional District'

Regarding the serial arsonist sample, the total N of serial arsonists = 7 with the total N of arson locations = 69 and the total N of residences for the serial arsonist sample at the time of each series committed = 12. Thus, the total number of location points spatially analyzed for the serial arsonist sample = 81. Table 2 and 3 display the specific N of location points attributed to each serial arsonist in this sample and the sample totals.
Table 2. Summary Table of Serial Arsonist Sample

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>'N' of Arson Locations</th>
<th>'N' of Resident Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vancouver</td>
<td>26</td>
<td>2</td>
</tr>
<tr>
<td>Burnaby</td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td>North Vancouver (2 arsonists)</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Penticton</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Saanich #1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Saanich #2</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 3. Summary Totals of Serial Arsonist Sample

<table>
<thead>
<tr>
<th>Total 'N' of Serial Arsonists</th>
<th>Total 'N' of Serial Arson Locations</th>
<th>Total 'N' of Serial Resident Locations</th>
<th>Total 'N' of Serial Location Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>69</td>
<td>12</td>
<td>81</td>
</tr>
</tbody>
</table>

**Spatial Analyses**

In this research project, the point pattern maps are two dimensional in nature, exhibiting the locations of both arsons and the arsonist's residence overlaid on the street networks of each jurisdiction within which the crimes occurred. This in essence is the definition of cartography; three-dimensional objects are displayed as symbols in two-dimensional planes (Boots and Getis, 1998). The visualizations produce a thematic map exhibiting quantitative data of addresses. The theme of each point pattern map explores 'distance traveled' in the crime site selection process of arsonists from their residential location. Due to the fact that only one attribute is being examined by point pattern analysis.
(distance traveled), the spatial-statistical ESDA is univariate in nature and can only offer informal statistical inferences on the spatial patterns of criminal target selection processes (Fotheringham, Brundson and Charlton, 2000). The utility of informal inferences arising from ESDA techniques will be discussed further at a later point in this chapter.

A point pattern map exhibiting arson and offender resident locations was produced for all four jurisdictions in the single time arsonist sample (N of point pattern maps= 4) and for each series across five jurisdictions in the serial arsonist series (N of point pattern maps= 10).

Point Data

The data sets obtained from the two police databases (PIRS and PRIME) contained the point data needed for the spatial-statistical analyses. For each arson case, two addresses were documented, the arson location and the resident location(s) of the offender(s) charged with the arson. These addresses were geocoded into point data for spatial analysis via a geographical mapping program called ArcView GIS 3.2. The process of geocoding involves creating an X and Y coordinate for each address in order for the mapping program to plot the locations onto a basemap of any given area (e.g., Vancouver).

It is important to note that geocoding is not an automated process free of human subjectivity. Certain errors of data entry or omission exist in crime databases that are often the source from which point data is obtained. For example, common errors that make geocoding for crime mapping onerous may stem from encountering the wrong directional identifier (e.g., Using ‘East’ when
the address necessitates ‘West’), giving the wrong street suffix (e.g., Using ‘Avenue’ when the address is on a ‘Court’), dealing with an out-of-range address or addresses not being entered at all (Harries, 1999). Such oversights are likely to cause ‘misses’ in the geocoding process affecting the overall ‘hit rate’; the percentage of addresses recognized by the software in the geocoding process. In this research project, 7 out of 167 addresses were excluded from the point pattern maps and distance analyses, as the software program was unable to recognize the addresses².

**Distance Measurements and Buffer Visualizations**

**Distance Measurements**

The primary attribute of interest in this research project was the distance traveled by arsonists in their target selection processes. For both the single time and serial arsonist samples, the distance in kilometers was measured from the residential location of the charged arsonist to the site where the arson occurred. Distance in spatial analysis has been measured in various manners. One commonly used method termed ‘Euclidean’ or ‘ Straight-Line’ measures a straight line from one spatial point to another (Fotheringham et al., 2000). In Criminology and Law Enforcement practices, this method is often termed ‘crown’s flight distance’. Another method commonly used to measure distance is termed the ‘Manhattan Metric’, which analyzes distance between two spatial points based on a grid structured movement path. Lastly, a less commonly used method of distance analysis is ‘Actual Route Distance’ which estimates potential routes

² That is, 96% of the addresses were successfully geocoded and analysed.
taken by the traveler, not necessarily sticking to major road networks (Fotheringham et al., 2000).

The choice of distance measure to utilize in spatial analysis research is reflective of an oscillation between maximizing objectivity and minimizing the ecological validity of one’s results. The ‘crow’s flight distance’ measure is arguably the most objective method of measuring distance as it involves the drawing of a straight line from one point to another; a method high in reliability, yet low in validity. When the distance being measured reflects a route traveled by human beings, the ‘crow’s flight’ method falls short in its depiction of real life travel patterns as people are for the most part physically unable to travel from one point to another in a perfectly linear, straight-line fashion. Buildings, road networks, forests, water bodies and many other structures get in the way of such a linear travel path. The ‘Manhattan Metric’ method arguably offers greater validity as it is predicated on existing road networks, yet because the researcher is reliant on the computer software program to pick the major road networks most likely chosen by the traveler, the measurement of distance lacks the recognition that persons often choose routes that are less frequently traveled. With regard to the ‘Actual Route Distance’ method, it is the argument of this researcher that the decrease in objectivity experienced as a byproduct of utilizing this method is more than made up for by the ecological validity gained which is provided by the fact that the method allows the travel patterns to include paths other than major road networks. This arguably may reflect greater validity in examining distances where the traveler is on foot. People do not travel to destinations solely based
on major road networks; rather, it can be argued that people utilize side-streets and paths that veer from major traffic arteries that reflect a high level of knowledge and experience with the area one resides or commonly functions within for everyday activities.

This research project used the 'Actual Route Distance' method to measure the distance traveled from residence to crime scene for all arsonists. It was the opinion of the researcher that in order to be able to make inferences about the target selection processes of arsonists, the distance measurements between the primary activity node of the residence and the crime site location ought to include a route reflective of familiarity, knowledge and confidence in one’s surroundings. This is because most literature examining similar phenomenon find that people engage in criminal activity close to their primary activity nodes in areas that constitute a perceived high level of geographic knowledge. In such areas, it is argued that criminals would not solely choose major road networks to select targets, rather, that they are likely to choose a path that is most convenient and that will minimize detection. It was decided by the researcher that the 'Actual Route Distance' method of distance measurement was advantageous over the others in this regard. Thus, the researcher measured the attribute of distance according to both major road networks and numerous side or back streets.

**Buffer Visualizations**

A buffer is a specified zone around an object that has some investigative or analytical significance (Harries, 1999). For the serial arsonist sample, the researcher developed two types of circular buffer zones projecting outward using
the charged arsonist's residential location as the point of origin. One buffer visualization projects outward from the residence with 50-meter radii zones; the other with 1 km radii zones. These buffers show the proportion of arsons located within the above mentioned distance intervals from the residential origin. Two buffer visualizations (50-meter and 1 km) were produced for each serial arsonist series (N of buffer visualizations= 22).

Utility of Visualization Techniques in ESDA

In this research project, point pattern maps and buffer zones are two forms of visualization used to assess the target selection processes of arsonists in terms of the distance traveled from the primary activity node of residence to crime scenes. As is indicative of social science research in general, this project is unable to prove or disprove underlying mechanisms that may be responsible for spatial patterns observed; however, significant insight can be gleaned at the informal level with regards to the phenomenon of criminal target selection processes from the use of such visualization techniques. Within the ESDA process, the use of point pattern maps is a good place to start to obtain initial insight about spatial patterns observed and to begin the process of generating explanations behind spatial phenomena (Boots and Getis, 1988). The level of spatial inference provided by the analysis of point pattern maps is informal in nature due to the fact that the data output is solely visual, not statistical and the techniques used for analysis are exploratory, not explanatory in nature. For example, the buffer visualizations conducted on the distances traveled to crime scene by serial arsonists in this research project do not provide a measure of
spatial-statistical significance. What the visualizations do offer is an essential starting point of observing patterns and providing a basis from which additional questions may arise.

Fotheringham et al. (2000) strongly supports the use of visualization techniques in the ESDA process. The utility of such methods are stated as being able to identify geographical patterns, to assess whether or not spatial data points are further apart (or closer) than a random dispersion, to observe spatial trends and to explore what may be considered spatial outliers with the phenomenon of interest. These advantages of visualization techniques translate into a highly useful method of spatial exploratory research in Criminology. For example, with regard to this research project, the point pattern maps allowed for informal inferences to be made about the spatial patterns of arson target selection, the pattern of selecting targets close to primary activity nodes and allowed for the identification of spatially anomalous target selection processes. These informal inferences from the visualization techniques spawned considerable hypotheses and future research questions (see Chapter Five).

**Statistical Analyses**

**Descriptive Statistics and Distance Travelled to Crime Scene**

For the initial stage of the ESDA, measures of central tendency were calculated to assess the variable of distance travelled from residence to crime scene for the arsons in both sample groups. Specifically, for the single time arsonist sample, the minimum, maximum, mean, median and standard deviation distances (km) travelled to the crime scene were calculated for the arson activity
in each jurisdiction. For the serial arsonist sample, the same descriptive statistics were generated, however for each individual series committed by the serial arsonist. The descriptive analyses were combined within each sample for a comparative univariate analysis of 'distance travelled' to crime scene between single time arsonists and serial arsonists.

Additionally, frequency distributions for the variable of distance travelled were conducted for each sample within 1 km distance intervals and also within 50-meter distance intervals for the serial arsonists. Thus, for both samples, the percentage of distances travelled to crime scene falling into specified distances is reported providing a comparative univariate frequency distribution between single and serial arsonists samples regarding the target selection process as well as a combined distribution of distances travelled for the population of arsonists as a whole.

**Descriptive Statistics on Age of Arsonist at the Time of Offence Commission**

In this Exploratory Data Analysis, the age of the sample was also of interest. Thus, measures of central tendency were also calculated to assess the distribution of age for each arsonist sample and for the population as a whole. Specifically, the mean, median and standard deviation of ages for each sample were calculated and then analysed as one categorical variable compiling the distribution of ages together. Additionally, the proportion of young offenders (ages 12-17 years) versus adult offenders (18 years and older) in each sample
was analysed. The results are presented in tabular and chart form for visual purposes.

**Sex of Offender and Target Type of Arson**

The proportion of male-to-female arsonists was calculated for the population as a whole and presented in a pie chart. This variable was not assessed dichotomously between the two samples, as the number of female arsonists was so small that reporting on the variable of sex within the population as a whole was seen as sufficient.

Finally, the target type of each arson is listed in tabular format in Appendix B. The target types are divided into those found in the single time arsonist sample and those of the serial arsonist sample. The number of targets listed is fewer than the number of arsons included in the spatial analysis. This is due to data omission found in the police databases. The variable of 'target' was not consistently entered in these databases and thus not all targets are reported in this research project.

**Inferential Statistics**

To assess whether there existed any degree of association between the variables of age and distance travelled, the Pearson’s correlation coefficient was conducted on these variables for each sample. A correlation coefficient was obtained between age and distance travelled for the single time arsonist sample as well as for the serial arsonist sample.
To assess the degree of difference between the samples regarding age and distance travelled to crime scene, a t-test was conducted assuming unequal variances between the samples with a significance level set at 0.05. The t-test statistic was of interest to ascertain whether the differences seen between the means obtained with both samples on the variables of distance travelled to crime scene and age were statistically significant. If the t-test statistic obtained has a low probability of occurrence (0.05 or less) it allows the researcher to conclude that the differences in the means obtained between two groups on the variable of interest are significant and may reflect a true difference in that population regarding that attribute. It is at this point that the researcher may reject the null hypothesis that no statistically significant difference above random chance exists between the two groups assessed (Cozby, 1997; Palys, 1997).

Methodological Considerations

In the process of data collection, certain issues arose pertaining to case inclusion and omission with regards to the parameters set for the sample criteria. Additionally, inconsistencies between sample 'N's used for various analyses surfaced during data analysis. It is at this time that the researcher would like to address such issues in order to further clarify the population of interest and to explicate what may potentially be seen as methodological inconsistencies.

First, as was mentioned before, the criterion for inclusion in the sample was that a charge of arson be laid to the offender. Including this criterion dramatically narrowed the sample size of the study. The crime of arson is rarely cleared with a charge being laid (Hall, 1995). Having spoken with Arson
Investigators, it can be said anecdotally that this is due to the fact that arson is rarely witnessed, often being committed overnight and not involving human victims. Additionally, the fire often burns potential evidence. Thus, one criticism to the sample criteria may be the exclusion of suspects, which if included would have significantly increased the sample size for the study. However, the primary purpose of the research project was to be able to identify the spatial patterns of arsonist target selection. Oftentimes, suspects are incorrectly identified for various reasons; thus, their inclusion would have introduced residential locations of persons not necessarily responsible for the fires being analysed, which would have questioned the validity of the spatial analyses conducted. Setting the parameter of including only charged persons provided the researcher with the greatest possible reassurance that the spatial patterns identified were representative of actual arsonist target selection processes. Thus, the sample size was minimized in favour of attempting to ensure the validity of the population of interest.

Second, for the serial arsonist sample, the definition of 'serial' was derived from a serial arson study conducted jointly by the Federal Bureau of Investigation and the National Centre for the Analysis of Violent Crime (NCAVC) (Sapp et al., 1998). That definitive study identified a 'serial arsonist' as one who commits three or more arsons with a cooling off period between the fires. A serial arsonist is not the same as a 'spree arsonist' who sets three or more fires at separate locations with no emotional cooling-off period between the fires (Sapp et al., 1998). Some of the serial arsonists included in this study committed more than
one fire on the same date in addition to offending on separate dates thereafter.
In cases where the serial arsonist set more than one fire in one day, the
researcher only included and analysed the arson that was documented by Law
Enforcement as having occurred first temporally. For example, if a serial arsonist
set two fires in one day, one at 7:10am and one at 7:30am, the fire documented
by Law Enforcement as having occurred at 7:10am was the only arson
considered for analysis. The reason for not including all fires set in one day is
predicated on a potential skewing of the spatial analysis. If the spree arsons
occurred in close proximity to one another and also close to the residential
location, any spatial significance observed in terms of the attribute of distance
travelled to crime scene would be inflated and not due to target selection
processes per se. As a researcher, it is presumptuous to assume that during a
spree arson, the arsonist returns to his or her residence between each fire that is
set as it is far more likely that the arsonist travels to the next crime site from the
previous arson location. The spatial analysis, however, would have entailed a
distance measurement for each spree arson originating from the residential
location of the arsonist. Once again, if the arsons were in close proximity to one
another in addition to being somewhat close to the residential location, the
distance measurements yielded would have inflated the spatial analyses of the
target selection process.

Third, there were a few arson cases in which a charge was laid on the
offender, yet the case was excluded from analysis. These cases were of two
types: when the charged arsonist was the registered owner of the vehicle set on
fire or the owner of the property set on fire. These types of cases were excluded as they mostly represented arsons committed for insurance purposes; however, more importantly they did not include a target selection process. The offender either did not travel at all, setting fire to his/her own residence, or set fire to their own vehicle in which case the choice of location was not indicative of a target selection process per se.

Fourth, there were two arson cases in the jurisdiction of Maple Ridge within the single time arsonist sample that were excluded from the data. These cases involved arsonists who travelled approximately 40 km from their residence to the arson location and as such represented anomalous spatial patterns. Due to the fact that they constituted spatial outliers, their cases were excluded from analyses.

Lastly, there also exists a small amount of inconsistency between the N used for the distance measurements in the single arsonist sample and the subsequent N used for the frequency analysis of age in that sample. This is due to omissions within the police databases from which the data is drawn. For example, in the city of Vancouver, two persons may be charged with setting one fire, however only one of the offender's addresses is documented in the database. This would provide one measure for the distance travelled variable (only one offender address available), and two measures for the variable of age (both offender's date of birth is documented). Such inconsistencies are minute in size within the study, yet required mention.
CHAPTER FOUR: RESULTS

The results chapter is divided into two parts; results pertaining to the single time arsonist sample and the serial arsonist sample. The results are presented in two formats, figures and tables. The figures include point pattern maps, buffer visualizations, bar charts, pie charts and line charts. The tables present the results in numerical format for various descriptive and inferential statistics. The results for the single time arsonist sample will be discussed first, followed by the results found for the serial arsonist sample and the categorical variable of ‘total arsonists’ with a comparative analysis between the two groups concluding the chapter.

Distance Travelled from Residence to Crime Scene

The primary purpose of the study was to examine the target selection patterns of arsonists in terms of the distance travelled from residence to crime scene. It was of interest to the researcher to explore whether arsonists offend within their awareness space, close to the primary activity node of their residence, or whether they travel outside of an area that constitutes familiarity to them. The variable of ‘distance travelled’ was measured via the Actual Route Distance method in ArcView GIS 3.2 and was calculated in kilometres. The arsonist’s residential location at the time of the charge was used as the point of origin in the distance calculations.
**Single Time Arsonist Sample**

The single time arsonist sample is comprised of offenders who were charged with arson once, according to police records. Figure 2 is a map of Vancouver showing the point patterns of both arson locations and the concomitant residential locations of offenders charged with the arsons. The N of distances measured for this jurisdiction was fourteen. The average distance travelled from residence to crime scene was 2.1 km (S.D. = 2.2 km) with a minimum of 0.12 km and a maximum of 7.64 km. The median was 1.31 km. From this map, it appears that the arsonists are not travelling very far from their residences to select targets and as such favour areas indicative of an awareness space.
North Vancouver is a considerably smaller jurisdiction, however the distances travelled by arsonists to set fires was larger compared to Vancouver. The N of distances measured for North Vancouver was ten. The average distance travelled was 5.88 km (S.D. = 4.3 km) with a minimum of 0.10 km and a maximum of 12.55 km (see Figure 3). The average was driven upwards by three cases in which the arsonists travelled 7.49, 9 and 12.55 km's respectively. These cases were not excluded though, as the offenders remained within the jurisdictional boundary when selecting targets. The median distance was 6.41 km.
Figure 4 shows the map of Coquitlam, a jurisdiction located approximately thirty minutes East of Vancouver. Coquitlam, in comparison to Vancouver, may be viewed as a suburb. The N of distances measured for Coquitlam was twelve. The average distance travelled to the crime scene by arsonists in Coquitlam was 2.9 km (S.D. = 3.18 km) with a minimum of 0.08 km and a maximum of 11.77 km. The median distance travelled was 2.45 km.
The last jurisdiction included for analyses in the single time arsonist sample was that of Maple Ridge. Maple Ridge is located approximately 1.5 hours east of Vancouver. Of the four jurisdictions in the single time arsonist sample, Maple Ridge is the city most characteristic of a suburb. The N of distances measured was sixteen. The average distance travelled to crime scene for the arsonists in Maple Ridge was 3.2 km (S.D. = 3.87 km) with a minimum of 0.61 km and a maximum of 13.12 km (see Figure 5). These calculations were driven upwards by one case in which the arsonist travelled 13.12 km to the crime scene, however due to the fact that this distance still
remained within the city of Maple Ridge, the case was not excluded. The median distance was 1.56 km, arguably a more representative measure of the distances travelled by arsonists in Maple Ridge due to the one spatially anomalous case.

Figure 5. Maple Ridge Single Time Arsons with Residences of Charged Offenders

Figure 6 is a bar chart depicting the percentage of cases per jurisdiction where the arsonists travelled within various distance intervals from their residence to set fires. It is shown that approximately 25% of the cases in each jurisdiction involved arsonists setting fires less than 1 km from their residence at the time of the crime. Vancouver was the city exhibiting the highest percentage of arsonists remaining close to their primary activity node when selecting targets,
with 72% of the arsonists offending 2 km or less from home. Arsonists travelled the farthest in North Vancouver, with 70% of cases involving a distance travelled of more than 3 km to set fires.

Figure 6. Bar Chart for Single Time Arsonist Sample of Distance Travelled to Crime Scene

Also included in Figure 6 is a total for the Greater Vancouver Regional District (GVRD), which reflects a total for the cities included in this study only. It shows that the largest percentage of cases for all cities combined fall into the distance interval of 2 km or less, specifically with 28% of the cases in total involving a target selecting process less than 1 km from the offender's residence. This suggests that single time arsonists in the Greater Vancouver area show a strong proclivity to remain close to their primary activity node of residence when selecting targets and as such show patterns similar to offenders of other various crime types (Warren et al., 1998; Wiles and Costello, 2000). It is also important to highlight the results found for the distance interval of greater than 3 km (see
Figure 6). No less than 20% of cases within each jurisdiction involved a target selection process within this distance interval with 37% of the total cases for the GVRD exhibiting this travel pattern. The proportion of cases falling into this distance interval was surprising considering the repeated pattern found in literature of offenders remaining 1 to 2 km within their awareness spaces to select targets. Potential explanations for this finding will be discussed in the following chapter.

Figure 7 presents a comparison for measures of central tendency between each jurisdiction in the single time arsonist sample and for the GVRD as a whole (all four jurisdictions combined). The largest average for distance travelled to crime scene was found in North Vancouver at 3.7 km with the largest standard deviation of 3.7 km. The smallest average distance travelled was found in Vancouver (2.1 km), also exhibiting the smallest variability in target selection patterns (SD= 2.2 km). The average distance travelled for all four jurisdictions combined was 3.38km (S.D. = 3.53 km). Thus, despite the larger proportion of cases falling into the distance interval of 'greater than 3 km', the single time arsonists, in the GVRD as a whole appear to select targets within their awareness space.
Serial Arsonist Sample

For the purposes of this study, a serial arsonist was defined as an offender charged with three or more arsons with a cooling off period in between each incident (Sapp et al., 1998). For each serial arsonist discussed, five types of results will be presented. The first are point pattern maps, followed by the results found for the 1 km buffer visualizations, then the findings for the 50-meter buffer visualizations, bar charts indicating percentages of cases falling within certain distance intervals and lastly, a line graph according to the 50-meter travel patterns found.

Vancouver Serial Arsonist

The results found with the Vancouver Serial arsonist will be discussed first. This arsonist was male and according to the Vancouver Police Department,
was charged with setting two separate series of fires, one in 1989 and the last in 2001. His age in 1989 when he received his first charge of arson was 20 years and 32 years in 2001. Figure 8 is the point pattern map showing his residential location and the concomitant arsons to which he was eventually linked, during the first series in 1989. The N of arsons, and subsequent distance measurements utilized for the spatial analysis of this series was twelve. The average distance travelled to set fires was 0.89 km with a standard deviation of 0.7 km. The median distance travelled was 0.82 km. It is clear from the point pattern map that he chose targets very close to his primary activity node of residence during the target selection process. This pattern becomes very clear in Figure 9, the 1 km buffer visualization. His residence in 1989 is used as the point of origin with each coloured circle representing a 1 km buffer projecting outward from the central point. The 1 km buffer shows that the majority of the arsons are clustered around his residence within the 1 km distance interval.
Figure 8. Vancouver Serial Arsonist, 1st series
Figure 9. 1 km Buffer Visualization, Vancouver Serial Arsonist, 1st series

Figure 10 depicts the 50-meter buffer. This visualization presents a more detailed analysis of the target selection processes of this serial arsonist. Despite the fact that he showed a strong proclivity to remain close to his residence when setting fires, the first 50-meter distance interval is free of arson targets, with target selection beginning within the 100-meter distance interval. This may suggest a balance in the target selection process between fulfilling the desire to remain in an area to which one is familiar with avoiding the detection of one's immediate neighbours; arguably people by whom one is most likely to be recognized. Additionally, this pattern may be indicative of the arsonist attempting
to ensure that the fire would not reach their own residential location as the embers from a burning building or object can easily spread to neighbouring locales. This spatial pattern of reduced criminal target selection will be referred to as the existence of an 'avoidance zone' synonymous to the 'buffer zone' previously discussed (Brantingham and Brantingham, 1981; Rossmo, 1995).

Figure 10. 50-meter Buffer Visualization, Vancouver Serial Arsonist, 1st series

The second series of arsons for the Vancouver Serial Arsonist occurred in 2001, with a total of fourteen fires. Figure 11 is the point pattern map showing his residence at the time of this series and all the fires to which he was eventually linked. In this series, twelve years later, he still shows a strong proclivity to
remain close to his current residence when selecting targets. The average
distance travelled to set fires was 1.4 km with a standard deviation of 2.2 km.
The median distance travelled was 0.95 km. The 1 km buffer for this series
shows very similar patterns of offending compared to the first series, twelve
years prior (see Figure 12). It is clear that the vast majority of the arsons are
located within 1 and 2 km from his residence at the time of the series. However,
from the 50-meter buffer, the pattern of avoiding areas directly surrounding his
residence is mostly cogently shown (see Figure 13). The target selection
process in the second series is non-existent in the first 150-meters from his
residence and begins in the 200-meter distance interval. This pattern overall is
illustrated in Figure 14 as a line graph showing the percentage of cases in both
series combined that fall into 50-meter distance intervals from the respective
resident locations. It is shown that a very small percentage of the arsons, in
total, were committed 250-meters or less from the resident location with a sharp
increase in target selection occurring at the \(\frac{1}{4}\) km distance interval. Despite a
slight decrease occurring within the 250-500-meter distance interval, the
distances within the target selection process exist in a linear fashion, beginning
at 250-meters from the residential location. Thus, this serial arsonist’s target
selection process exhibited the phenomenon of the ‘avoidance zone’ in both
series, twelve years apart.
Figure 11. Vancouver Serial Arsonist, 2nd series
Figure 12. 1 km Buffer Visualization, Vancouver Serial Arsonist, 2\textsuperscript{nd} series
Figure 13. 50-meter Buffer Visualization, Vancouver Serial Arsonist, 2nd series
Returning to the 1 km distance intervals, Figure 15 shows a bar chart that clearly depicts the 'distance-decay phenomenon'; that the proportion of crimes will decrease as the distance increases from a frequented activity node. One can see from the bar chart that the highest percentage of arsons in total with the Vancouver Serial Arsonist occurred within the ‘less than 1 km’ distance interval and begin to continuously decrease with each further interval. The minimum distance travelled for this serial arsonist was 0.05 km with a maximum distance of 6.51 km.
The second serial arsonist in the study is a female who resided in both Burnaby and New Westminster, municipalities neighbouring Vancouver to the East. This arsonist was linked to five separate fire setting series from 1992 to 2002, the last of which resulted in a homicide. She was 26 years old during the first series and continued to set fires until the age of 34 years. The researcher spoke directly with two Sergeants who worked on the case, one of whom had direct contact with this serial arsonist on numerous occasions. Figure 16 depicts the point pattern map of her first series in 1992 located in Burnaby. The average distance travelled to set fires from her residence at the time was 0.73 km with a standard deviation of 0.75 km. The median distance was 0.42 km. It is interesting to note from Figure 16 that most of the arson locations are in close proximity to a major shopping complex in Burnaby, Metrotown. Metrotown is
situated almost directly in between this arsonist’s target locations, north of Imperial Street and south of Kingsway. There are two potential explanations for this finding. She may have been venturing towards this crowded locale because it represented an activity node that she frequented daily and thus was familiar or comfortable in such surroundings. It also may be that she sought anonymity during her fire-setting activities; Metrotown being a highly dense shopping centre in terms of patrons passing through allows one to remain anonymous and situated in large crowds. Similar to the patterns seen with the Vancouver Serial Arsonist, Figure 17 shows that the vast majority of the arsons were located less than 1 km from the residential activity node. However, it is also clear that if the variable of distance travelled is viewed through a finer scope of resolution with the 50-meter buffer visualization, she began to select targets at the 150-meter distance interval from home (see Figure 18). Thus, as with the Vancouver Serial Arsonist, the female arsonist in Burnaby may have been balancing a desire to select targets in an area constituting familiarity and predictability while attempting to avoid detection from directly surrounding neighbours.
Figure 16. Burnaby Serial Arsonist, 1st series
Figure 17. 1 km Buffer Visualization, Burnaby Serial Arsonist, 1st series
In 1994, the same female arsonist continued to set fires. Figure 19 is the point pattern map depicting her residence at the time of this second series and the concomitant arsons with which she was later linked. The average distance travelled from the residential activity node was 0.34 km with a standard deviation of 0.07 km. The median distance travelled was 0.36 km. This series exhibited her strongest proclivity to remain close to home when selecting targets. Figure 20, showing the 1 km buffer visualization illustrates that all of the arsons in the second series were located less than 1 km from her home. However, it is even more interesting to note that despite the fact that this arsonist shows a repetitive
pattern of offending within her awareness space, the targets selected are not within the *immediate* or direct vicinity of her residence (see Figure 21). The 50-meter buffer visualization clearly shows that with the second series, the target selection process of this serial arsonist does not begin until she is one-quarter of a kilometre from home, or 250-meters. Thus, as seen with other previously mentioned cases, serial arsonists seem to exhibit a pattern of offending within an area of familiarity and daily activity, while evading areas encompassing those who are arguably most likely to detect the aberrant behaviour; their neighbours.
Figure 20. 1 km Buffer Visualization, Burnaby Serial Arsonist, 2\textsuperscript{nd} series
Two years later, during her third series of fire setting, this serial arsonist moved to a municipality neighbouring Burnaby to the east known as New Westminster. The average distance travelled from her residence to the crime scene begins to increase in comparison to her two previous series. However, it is important to note that her pattern of offending close to primary activity nodes of residences does not change; she begins to return to areas surrounding previous residential locations. The average distance travelled to arson locations in this third fire setting series was 2.9 km with a standard deviation of 4.3 km (see Figure 22). The median distance travelled was 0.59 km. The 1 km buffer
visualization in Figure 23 shows that two out of the three arsons were located less than 1 km from her residence in New Westminster during this series. The third arson at first glance appears to be spatially anomalous, as it is located in the city of Burnaby; however, Figure 23 shows that it is in fact located less than 2 km from her residence during her first series of fire setting in 1992. Thus, despite the fact that this serial arsonist travelled outside of a jurisdictional boundary to select a target, she still exhibited the predictable pattern of offending within an awareness space; albeit, a former one encompassing a prior residence. Figure 24, though, presents a repeated pattern found with this arsonist; none of the arson locations that were located within the 1 km radius were within 250-meters from her residence in New Westminster. She appears to remain vigilant in not targeting immediately surrounding areas.
Figure 22. Burnaby Serial Arsonist, 3rd series
Figure 23. 1 km Buffer Visualization, Burnaby Serial Arsonist, 3rd series.
Series number four exhibits similar patterns. In Figure 25, it is shown that the arson locations once again span across the two jurisdictions of New Westminster and Burnaby. The residential location in New Westminster in 1998 is different from the one in 1996. In this series, the largest average distance travelled was demonstrated at 6.5 km with a standard deviation of 4.3 km. The median distance travelled was 6.38 km. Once again, from the point pattern map in Figure 25, her target selection patterns may appear spatially anomalous when compared to her residential location at the time of the series; however, the buffer visualizations illustrate the strong proclivity of this arsonist to offend within
existing and former awareness spaces. The 1 km buffer visualization for the
fourth series shows that two out of the four arsons in this series are located
within 1 km of her residence during the third series, and the two arsons in
Burnaby are within 2 and 3 km of her prior residence during the second series in
1994 (see Figure 26). Thus, this serial arsonist exhibited consistent spatial
offending patterns remaining very close to primary activity nodes of residences
that may have constituted an awareness space in which she would have felt
most confident in her capability to commit the crimes. Figure 27, however,
demonstrates that she avoided the first 250-meters, or ¼ km when selecting
targets, in keeping with the patterns seen in her prior series'.
Figure 25. Burnaby Serial Arsonist, 4th series
Figure 26. 1 km Buffer Visualization, Burnaby Serial Arsonist, 4th series
During her last series in 2000, she returned to the city of Burnaby and continued to commit arsons for two years before the final one resulted in a homicide. Figure 28 is the point pattern map showing her residence during this fifth series and the concomitant fourteen arsons to which she was later linked. The average distance travelled from residence to crime scene was 0.41 km with a standard deviation of also 0.41 km. The median distance travelled was 0.33 km. It becomes clear that this arsonist became increasingly brazen with regard to her target selection patterns in that the arsons were located extremely close to her residence at the time of the series. Figure 29 shows that a large number of
arsons were located less than 1 km from her home; however, most surprising was the proportion of arsons located within the $\frac{1}{4}$ km distance intervals that were previously avoided during the prior four series'. It was found that she was committing arsons less than 50-meters from her residence and continued to do so at the 100 and 150-meter distance intervals (see Figure 30). This pattern was only seen during the fifth and final series of fire setting, perhaps reflecting a developed confidence level in her capability to deliberately set fires without detection. As the confidence level built, it is arguable that she did not feel the need to avoid adjacent and surrounding areas of her residence.
Figure 28. Burnaby Serial Arsonist, 5th series
Figure 31 presents a bar chart of the percentage of arsons the Burnaby Serial Arsonist set within specified distance intervals from each residence. The chart shows that for the first, second, third and fifth series, approximately 65 to 100% of the arsons were located less than 1 km from her residence at the time of the commission of the arsons. Additionally, in total, for all the fire setting series combined, the Burnaby Serials Arsonist exhibited a target selection pattern indicative of the 'distance-decay phenomenon'. The proportion of crimes committed decreased as the distance from the primary activity node increased. Excluding the knowledge of the pattern of this arsonist to return to former
residential locations to select targets, Figure 31 shows that upon examining the variable of distance travelled, the Burnaby Serial Arsonist demonstrated a strong proclivity to remain within her awareness space, approximately 1 km from her existing residence in selecting targets. Yet, in light of her preference to remain close to residential nodes, she repeatedly avoided areas that were in the immediate vicinity of such nodes. Figure 32 shows that the avoidance zone appears to exist within her target selection from approximately 250-meters to ¼ km in which she avoided target selection, except during her last series. The percentage of cases increases from 3% within the 150 to 250-meter interval to
36% after 250-meters. It is clear that for the first eight years spanning four
different fire setting series, the Burnaby Serial Arsonist repeatedly demonstrated
the avoidance zone phenomenon in the target selection process. The minimum
distance travelled for this serial arsonist was 0.01 km with a maximum distance
of 10.74 km from home to crime scene.
Figure 31. Bar Chart of Distance Travelled to Crime Scene for Burnaby Serial Arsonist

Figure 32. Line Graph of Total Distances Travelled to Crime Scene for Burnaby Serial Arsonist

Burnaby Serial Arsonist

< 1km  1-2km  2-3km  > 3km

1st Series, '92/93
2nd Series, '94
3rd Series, '96
4th Series, '98
5th Series, '00/02
Total

Burnaby Serial Arsonist

0-50m  50-100m  100-150m  150-250m  250-500m  500m-1km  > 1km

Distance (m and km)
North Vancouver Serial Arsonists

The third serial arson case involved two youths from the city of North Vancouver in 2000. They were friends and resided very close to one another (see Figure 33). The point pattern map shows two residences; the one on the left most side will be referred to as 'arsonist 1' and the one on the right most side; 'arsonist 2'. The average distance travelled for arsonist 1 from his residence to the crime sites was 1.35 km with a standard deviation of 1.05 km. The median distance travelled was 1.94 km. The average distance travelled for arsonist 2 was 1.46 km with a standard deviation of 0.99 km. The median distance travelled was 2.01 km. The minimum distance travelled for both arsonists was 0.15 km with a maximum distance of 2.39 km. These youths were under the age of 16, which would have prevented them from driving. It was known to the researcher that they did commit the arsons on foot. Thus, the finding that the arsons were no more than 2 km in distance from their respective residences is not surprising (see Figure 34). It is interesting to note, though, that the 50-meter buffer visualization reveals a target selection pattern similar to that of the two previously discussed serial arsonists (see Figure 35). The areas immediately surrounding the juvenile's homes are absent in the target selection process. The line graph in Figure 36 demonstrates a surge in arson activity approximately 500-meters or ½ km from the arsonists' respective residences. Therefore, the juvenile arsonist may be cognizant of avoiding areas immediately surrounding a primary activity node in the same manner as the adult offenders when selecting targets, exhibiting the avoidance zone as well.
Figure 33. North Vancouver Serial Arsonists

North Vancouver Serial Arsonists
2000

N. Vancouver Serial Arsonist’s residences
N. Vancouver Serial Arsons
GVRD Major Roads and Highways
GVRD Water
GVRD Roads

GVRD Roads

0.2 0 20 40 60 80 Kilometers
Figure 34. 1 km Buffer Visualization, North Vancouver Serial Arsonists

N. Vancouver Serial Arsonist's Residences
- N. Vancouver Serial Arsons

1 km Buffer
- 1
- 2
- 3
- GVRD Water
- GVRD Roads

Scale: 0.4 0.8 1.6 Kilometers
Figure 37 presents a bar chart showing the percentage of distances travelled for the North Vancouver Serial Arsonists that fell into specified intervals with regards to the target selection process. The distance-decay phenomenon is not as apparent in this case. The distribution of cases across distance intervals, in total, for both arsonists is almost equally divided, with 40% occurring less than 1 km and 50% occurring 2 to 3 km from their residences. The decrease in the percentage of cases within the 1 to 2 km radius is very apparent; however it is unclear as to why such a pattern emerged.
Figure 36. Line Graph of Total Distances Travelled to Crime Scene for North Vancouver Serial Arsonists

Figure 37. Bar Chart of Distances Travelled to Crime Scene for North Vancouver Serial Arsonists
Nonetheless, despite the fact that this serial arson case did not exhibit the distance decay phenomenon as intensely as the previously discussed cases, the propensity to select targets close to one's home in an area constituting an awareness space, remains a viable pattern with these young offenders.

Penticton Serial Arsonist

In 1999, a 32-year-old male was charged with setting four fires in the city of Penticton, a municipality located in the Okanagan region of British Columbia, southeast of Vancouver. Figure 38 is the point pattern map showing his residential location at the time of the series and the fires he was linked to. The average distance travelled to set fires was 1.6 km with a standard deviation of 0.7 km. The median distance travelled was 1.8 km with a minimum of 0.58 km and a maximum distance of 2.16 km. This serial arsonist, though selecting targets within his awareness space, preferred to travel farther on average in comparison to the other serial arsonists (see Figure 39). He did not exhibit as strong of a preference to select targets less than 1 km from his home in comparison to the other serial arsonists (see Figure 40).
Figure 38. Penticton Serial Arsonist

Penticton Serial Arsonist
1999
The 1 km buffer visualization also shows that only one out of the four fires was located in the first kilometre from the residential origin point (see Figure 40). Although favouring further distance intervals in comparison to previously discussed serial arsonists, the Penticton arsonist’s target selection patterns are analogous to the others with regards to the existence of the avoidance zone. Figure 41 shows that this arsonist avoided areas within ¼ km from his home and the line graph clearly depicts a complete absence of arson activity less than 250-meters from his residence at the time. Indeed, Figure 42 depicts a linear, exponential increase in the proportion of arsons committed once the offender has travelled more than 250-meters from his home area. The 1 km buffer visualization also represents a proclivity to remain within an awareness space.
when setting fires as none are located further than 3 km from the residential activity node; a pattern seen repeatedly with serial arson activity.

Figure 40. 1 km Buffer Visualization, Penticton Serial Arsonist
Figure 41. 50-meter Buffer Visualization, Penticton Serial Arsonist

Figure 42. Line Graph of Distance Travelled to Crime Scene for Penticton Serial Arsonist
The final serial arsonists this study analysed were both found in the city of Saanich located in the Greater Victoria area on Vancouver Island. The first was a man charged with setting fires in 1990 at the age of 26 years. He will be referred to as ‘Saanich Serial Arsonist #1’. The second was a man charged with setting fires in 2000 at the age of 34 years. He will be referred to as ‘Saanich Serial Arsonist #2’.

**Saanich Serial Arsonist #1**

Figure 43 is the point pattern map of Saanich Serial Arsonist #1’s residential location and five fires he was linked to. The average distance travelled in this series was 1.39 km with a standard deviation of 1.54 km. The median distance travelled was 0.6 km with a minimum distance of 0.44 km and a maximum of 4.06 km. The average calculation was driven upwards via one arson located approximately 4 km from the residential activity node. The 1 km buffer visualization reveals that three out of the five arsons were within 1 km of his home and all but one arson were committed 2 km or less from this same origin point (see Figure 44). Keeping in line with the target selection processes of the previously discussed serial arsonists; Saanich Serial Arsonist #1 avoided targeting any areas that were within 250-meters of his residential property. Figure 45 shows a complete absence of arson location points within the ¼ km distance interval from his residence. The line graph, once again, shows a surge of arson activity beginning at the 250-meter distance that peaks within the 250-meter to 500-meter distance interval with 40% of the cases located here (see
Figure 46). Additionally, the arson activity evidenced a decrease to only 20% within the 500-meter to 1 km distance interval and then increased again to 40% after he travelled 1 km from home.
Figure 43. Saanich Serial Arsonist #1

Saanich Serial Arsonist #1
1990

B.C. Roads
- Expressway
- Principal Highway
- Secondary Highway
- Major Road
- Local road
- Trail
- Ferry Route/Ice Road
- Bcmun.shp

0.8 0 0.8 16 2.4 3.2 Kilometers
Figure 44. 1 km Buffer Visualization, Saanich Serial Arsonist #1

Saanich Residence, 1st Offender
Saanich Arsons, 1st Offender
1km Buffer, Saanich, 1st Offender

Legend:

- Green square: Saanich Residence, 1st Offender
- Red circle: Saanich Arsons, 1st Offender

Legend:

- 1
- 2
- 3

Bar Scale:

0.7 0 0.7 1.4 2.1 2.8 Kilometers

North Arrow
Figure 45. 50-meter Buffer Visualization, Saanich Serial Arsonist #1

Figure 46. Line Graph of Distance Travelled to Crime Scene for Saanich Serial Arsonist #1
Saanich Serial Arsonist #2

Saanich Serial Arsonist #2 travelled the furthest on average. Figure 47 shows that the average distance travelled from his residence at the time was 2.09 km with a standard deviation of 0.36 km. The median distance travelled was 2.27 km with a minimum of 1.67 km and a maximum distance of 2.33 km. Despite having the largest average distance travelled, this serial arsonist exhibited comparable target selection processes in that he did not choose areas outside of a 3 km radius from his residence to set fires; additionally, he also demonstrated an avoidance zone. Figure 48 reveals that all three fires were within the 3 km radius from his home with two fires located within the 2 km buffer zone. Yet, the 50-meter buffer visualization shows that areas within ¼ km, from the same origin point, were entirely avoided within the target selection process (see Figure 49). The line graphs clearly depict that arson activity began approximately 500-meters to 1 km from his residence and increased linearly as the distance from his residence concomitantly increased (see Figure 50). Figure 51 demonstrates that Saanich Serial Arsonist #1 clearly favoured the area directly surrounding his residence when selecting targets as all of the arsons were within 3 km from his home. Saanich Serial Arsonist #2 displayed a more specific target selection range with 100% of the arsons located within the 1.5 to 3 km radius from his home (see Figure 51).
Figure 47. Saanich Serial Arsonist #2
Figure 48. 1 km Buffer Visualization, Saanich Serial Arsonist #2
Figure 49. 50-meter Buffer Visualization, Saanich Serial Arsonist #2
Figure 50. Line Graph of Distance Travelled to Crime Scene for Saanich Serial Arsonist #2

Figure 51. Bar Chart of Distances Travelled to Crime Scene for Saanich Serial Arsonists
Comparative Univariate Spatial Analyses

Distance Travelled to Crime Scene

When engaging in a comparison on the attribute of distance travelled to crime scene between the single time arsonist sample and the serial arsonist sample, three themes emerge. First, the distance-decay phenomenon is more apparent in serial arson activity. Second, the average distances travelled from the residential activity node within the target selection process is smaller with the serial arsonists than those who have committed arson only once. Last, the variability in the distances travelled is greater within the single time arsonist sample, as these arsonists exhibited travel patterns outside of the 3 km radius from residential activity nodes; a rare occurrence with the serial arsonists. In this section, the results of this comparative univariate spatial analysis will be stated; please refer to Chapter Five for a detailed discussion on the patterns found.

Figures 52 and 53 present the percentage of cases of arson activity, within both samples and as a total, that were located in specified distance intervals. Figure 52 shows that it is at the two most extreme distance intervals that the results are most disparate between the samples. For example, only 13% of the arson cases in the single time arsonist sample were located less than 0.5 km from the residences, however 43% of the serial arsonists chose targets within this distance interval. Also, 28% of the single time arsonists set fires more than 5 km from their residences, whereas only 7% of cases in the serial arsonist sample fell into this category. This 7% is derived from the instances where the Burnaby Serial Arsonist returned to former residential activity nodes to set fires; thus from
knowing the data, it can be inferred that none of the serial arsonists travelled greater than 5 km if one considers *all* residences (former and those at the time of the commission of the arson) as origin points. Despite the greater variation in the distances travelled by single time arsonists, the categorical variable of ‘all arsonists’ does evidence the distance-decay phenomenon; albeit more subtle when compared to the serial arsonist travel patterns. When looking at all the arsonists in total, 66% of the cases were committed in areas less than 2 km from the arsonist’s residence at the time of the crime, versus only 34% occurring over 2 km from the same origin point.

Figure 52. Comparative Bar Chart of Distance Travelled to Crime Scene

![Comparative Distances Traveled to Crime Scene](image)

Figure 53 also illustrates the patterns stated above. The line graph shows the large variability of arson occurrence across varying distance intervals for the single time arsonist sample and the strong distance-decay phenomenon of the serial arsonist sample. It is also interesting to note that the travel patterns seen
in the total arsonist category reflect those of the serial arsonists more than that of the single time arsonist sample, perhaps inferring that arsonists overall, whether they be one time offenders or serial in nature, are very likely to show a strong proclivity to remain within their awareness spaces when selecting targets.

Figure 53. Comparative Line Graph of Distances Travelled to Crime Scene

Figure 54 presents a bar chart showing the average, median and standard deviation of distances travelled to crime scene for both samples as well as a combined calculation total for all arsonists in the study. The average distance travelled for the single time arsonist sample was 3.38 km compared to 1.5 km for the serial arsonists. The minimum distance travelled for the single time arsonist sample in total was 0.08 km (80-meters) with a maximum of 13.12 km. This minimum distance travelled indicates that the single time arsonists may have been avoiding areas directly surrounding their residences similar to the serial
arsonists. Thus, the phenomenon of the avoidance zone may hold for the single time arsonists as well in that none of the cases exhibited arson locations within 50-meters of the arsonist's home. The minimum distance travelled for the serial arsonist sample is total was 0.01 km with a maximum of 10.74 km. The average total distance travelled for all arsonists in the study was 2.17 km. The median distance for the single time arsonist study was 1.73 km and 0.76 km for the serial arsonist sample. The total median distance travelled for all arsonists was 1.17 km. The standard deviation of distances was 3.56 km and 2.05 km for the single time and serial arsonist samples respectively. The overall standard deviation of distance travelled for all arsonists was 2.83 km. Table 4 presents this data in numerical format.

Figure 54. Comparative Bar Chart of Measures of Central Tendency for Distance Travelled to Crime Scene
Returning to the serial arsonist sample, it is important to note that when combined into one categorical variable of ‘all serial arsonists’, the patterns seen in each case at the individual level hold at the group level. For example, in Figure 55, the line graph illustrates the avoidance zone within the target selection process. Only 13% of the serial arson cases occurred within $\frac{1}{4}$ km or 250-meters from the arsonist’s residence. The arson activity increases substantially after the offender travels outside of this avoidance zone where 27% of the arsons were committed within 250 to 500-meters. Figure 56 gives a solid visual representation of the finding that the most frequently documented distance interval utilized by serial arsonists in their target selection process is that of less than 0.5 km from the central activity node of their residence.

<table>
<thead>
<tr>
<th></th>
<th>Mean (km)</th>
<th>Median (km)</th>
<th>Mode (km)</th>
<th>Standard Deviation (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Sample</td>
<td>3.38</td>
<td>1.73</td>
<td>1.34</td>
<td>3.56</td>
</tr>
<tr>
<td>Serial Sample</td>
<td>1.49</td>
<td>0.76</td>
<td>0.35</td>
<td>2.05</td>
</tr>
<tr>
<td>Total Sample</td>
<td>2.17</td>
<td>1.17</td>
<td>0.35</td>
<td>2.83</td>
</tr>
</tbody>
</table>
Figure 55. Line Graph of Distances Travelled to Crime Scene for Serial Arsonist Sample

Serial Arsonist Sample

Distance (m and km)

Percent

0-50m 50-100m 100-150m 150-250m 250-500m 500m-1km >1km
Descriptive Statistics for Sex, Age and Targets

Sex of Arsonists

The distribution of sex in this study overwhelmingly was male. The pie chart depicting this dichotomy shows that 50 out of 53 arsonists from both samples in total were male. (see Figure 57).
Age of Arsonists

The distribution of ages for the single time arsonist sample will be presented first, followed by the distribution of ages for the serial arsonist sample with a concluding comparative analysis between the two samples regarding the frequency of young offenders versus adult aged offenders.

For the Vancouver single time arsonist sample, 34% of the arsonists were young offenders (ages 12-17 years). Another 33% were between the ages of 18-30 years. A surprising 20% of the single time arsonists in Vancouver were between the ages of 41-50 years (see Figure 58). In North Vancouver, a larger proportion of the single time arsonists were juveniles at 40% (see Figure 59). Thirty percent of the sample was aged 18-25 with the next largest distribution falling in the 41-50 year age group (20%).
Figure 58. Distribution of Age for Vancouver Single Time Arsonists

Age Distribution of Vancouver Single Arsonist Sample, n=15

Figure 59. Distribution of Age for North Vancouver Single Time Arsonists

Age Distribution of North Vancouver Single Arsonist Sample, n=10
In Coquitlam, a similar frequency of juvenile arsonists is seen with 41% of the sample aged 12-17 years. Forty-two percent were aged 18-25 years with 17% between the ages of 31-40 years (see Figure 60). Lastly, the largest proportion of juvenile arsonists existed in the jurisdiction of Maple Ridge (see Figure 61). Those aged 12-17 years made up 60% of the single time arsonists in this city, 30% were aged between 18-25 years with the remaining offenders between 26-30 years old (10%).

Figure 60. Distribution of Age for Coquitlam Single Time Arsonists

Figure 62 illustrates the distribution of ages for the single time arsonist sample in total. It is shown that 42% of arsonists in this sample were young offenders, 30% in total were between the ages of 18-25 years and the remaining 28% were between the ages of 26-50 years old. In comparison, the serial arsonist sample is comprised of older individuals. As opposed to the single time
arsonists, the largest proportion of serial offenders were between the ages of 31-40 years (42%) (see Figure 63). The juvenile serial arsonist made up 17% of the sample while those aged 26-30 years comprised 33% of the sample.

Figure 61. Distribution of Age for Maple Ridge Single Time Arsonists
Figure 62. Distribution of Age for Single Time Arsonist Sample in Total

**Age Distribution of Single Arsonist Sample in Total, n=47**

- 12-17 years: 11%
- 18-25: 30%
- 26-30: 42%
- 26-30: 6%
- 31-40: 11%
- 41-50: 0%
- >50: 0%

Figure 63. Distribution of Age for Serial Arsonist Sample in Total

**Age Distribution of Serial Arsonist Sample, n=12**

- 12-17 years: 0%
- 18-25: 8%
- 26-30: 17%
- 31-40: 33%
- 41-50: 42%
- >50: 0%
Lastly, it was of interest to the researcher to compare the distribution of ages based on the dichotomy of young offender (ages 12-17 years) versus adult offender. Figure 64 shows this distribution for the single time arsonist sample while Figure 65 shows the same for the serial arsonist sample. It is shown that for the single time arsonist sample in total, the existence of the young versus adult arsonist is almost equally divided with 57% categorized as adult and 43% as young offenders. Upon analysing the same dichotomy with the serial arsonist sample, a very different picture emerges. From Figure 65, it is seen that the adult offender encompasses the vast majority of the sample (83%) whereas the young serial arsonist only makes up 17%. Thus, for the population of this study, serial arson activity appears to be primarily the work of adult males. The measures of central tendency for the variable of age per sample and in total are presented in numerical format in Table 5.
Figure 64. Dichotomous Distribution of Age for Single Time Arsonist Sample in Total

Dichotomous Frequency Distribution of Age for Single Arsonist Sample

- Young Offender (12-17 years)
- Adult Offender (18+ years)

43% for Young Offender
57% for Adult Offender

Figure 65. Dichotomous Distribution of Age for Serial Arsonist Sample in Total

Dichotomous Frequency Distribution of Age for Serial Arsonist Sample

- Young Offender (12-17 years)
- Adult Offender (18+ years)

17% for Young Offender
83% for Adult Offender
Table 5. Measures of Central Tendency for Age

<table>
<thead>
<tr>
<th></th>
<th>Average (yrs)</th>
<th>Median (yrs)</th>
<th>Mode (yrs)</th>
<th>Standard Deviation (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Sample</td>
<td>23</td>
<td>18.5</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Serial Sample</td>
<td>23</td>
<td>26</td>
<td>26</td>
<td>8</td>
</tr>
<tr>
<td>Total Sample</td>
<td>23</td>
<td>20</td>
<td>14</td>
<td>10</td>
</tr>
</tbody>
</table>

Targets of Arsonists

The number of targets reported in this study is not equal to the amount of arsons as this information was omitted from some of the cases in the police databases. Nonetheless, the target information is reported in tabular format for both the single time and serial arsonist samples in Appendix B.

Inferential Statistics

Pearson's R Correlation Coefficient

A correlation coefficient was calculated to assess the relationship between the variable of age and the distances travelled to crime scenes for both samples. The results show no significant correlation between age and distance travelled for the single time arsonist sample ($r = 0.07$). Additionally, the results for the serial arson sample also did not yield a significant correlation ($r = -0.06$). Thus, with regards to the offenders charged with arson in the Greater Vancouver
Region of British Columbia, the age of the offender was not significantly associated with the distances travelled to set fires.

**t-test**

A t-test was calculated to assess whether any statistically significant differences existed between the average ages found within each sample and the average distances travelled. The two-sample t-tests, assuming unequal variances were calculated with a significance level of 0.05. Table 6 presents the results for the t-test examining the average age between the two samples. The t-statistic for this analysis was 0.15, inferring that the differences in the average age of the single time arsonist sample (22.9 years) and the serial arsonist sample (26.7 years) was not statistically significant. Therefore the difference in the average ages found was no different than what may be found randomly, or by chance. Serial arsonists or arsonists engaging in fire setting behaviour only once do not differ significantly by age.
Table 6: t-test for Age between Single Time Arsonists and Serial Arsonists

<table>
<thead>
<tr>
<th>t-test: Two-Sample Assuming Unequal Variances b/w Average Age of Single Arsonists and Serial Arsonists</th>
<th>Variable 1</th>
<th>Variable 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>22.93617021</td>
<td>26.75</td>
</tr>
<tr>
<td>Variance</td>
<td>106.2349676</td>
<td>54.38636364</td>
</tr>
<tr>
<td>Observations</td>
<td>47</td>
<td>12</td>
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<tr>
<td>Hypothesized Mean Difference</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>t Stat</td>
<td>-1.463342512</td>
<td></td>
</tr>
<tr>
<td>P(T&lt;=t) one-tail</td>
<td>0.078453442</td>
<td></td>
</tr>
<tr>
<td>t Critical one-tail</td>
<td>1.713870006</td>
<td></td>
</tr>
<tr>
<td>P(T&lt;=t) two-tail</td>
<td>0.156906885</td>
<td></td>
</tr>
<tr>
<td>t Critical two-tail</td>
<td>2.068654794</td>
<td></td>
</tr>
</tbody>
</table>

Upon calculating a t-statistic between the average distances travelled between each sample, it was established that a statistically significant difference existed by sample type and the distances travelled in the target selection process, on average. Table 7 shows the t-statistic for this analysis; a statistically significant difference was calculated at 0.001, falling below the specified significance level of 0.05. The t-test reveals that there exists a statistically significant difference between the distance travelled by an arsonist depending on whether he or she sets fires serially or only once. The null hypothesis was rejected and the relationship found in the study between the two variables of sample type and distances travelled to crime scene were inferred as being greater than what would be found by random chance alone. Please see Chapter Five for potential explanations on this finding.
Table 7. t-test for Distance Travelled to Crime Scene between Single Time and Serial Arsonists

<table>
<thead>
<tr>
<th>t-test: Two-Sample Assuming Unequal Variances b/w Average Distances Traveled for Single vs. Serial Arsonists</th>
<th>Variable 1</th>
<th>Variable 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.382826087</td>
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<tr>
<td>Variance</td>
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<tr>
<td>Observations</td>
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<td>81</td>
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<tr>
<td>Hypothesized Mean Difference</td>
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<td>0</td>
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<td>df</td>
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<td>62</td>
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<tr>
<td>t Stat</td>
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<td>1.669804988</td>
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<tr>
<td>P(T&lt;=t) one-tail</td>
<td>0.000799675</td>
<td>0.00109935</td>
</tr>
<tr>
<td>t Critical one-tail</td>
<td>1.669804988</td>
<td>1.99896931</td>
</tr>
<tr>
<td>P(T&lt;=t) two-tail</td>
<td>0.00159935</td>
<td>0.00109935</td>
</tr>
<tr>
<td>t Critical two-tail</td>
<td>1.99896931</td>
<td>1.99896931</td>
</tr>
</tbody>
</table>
CHAPTER 5: CONCLUSION

The primary objective of this study was to assess the spatial target selection processes of arsonists across two criminal groups: single time arsonists and serial arsonists. Additionally, the data from both samples was combined into one categorical variable of ‘total arsonists’ for the final multivariate analyses of distance traveled, age and sex of arsonists in the Greater Vancouver Region of British Columbia. The findings from Chapter Four will be discussed, however the patterns found with regard to the primary variable of interest, distance traveled, will be the main focus. The chapter will begin by reiterating key concepts formerly introduced in Chapter One on crime site selection. Next, potential explanations for the patterns found within the single time arsonist sample and serial arsonist sample will be discussed, as well as the results found with ‘total arsonists’ regarding the distances traveled from residence to crime scene. Additionally, the results will be discussed in terms of how they fare in comparison with prior literature on the spatial patterns of serial crime. It is imperative to note that any generalizations towards arson target selection processes as a population can only be inferred towards the Greater Vancouver Region of British Columbia as the samples used were purposive and do not connote representativeness with regard to the spatial patterns of arson activity at a meso, or aggregate level. The utility of such findings will be discussed in regard to Law Enforcement practices within serial crime investigation and Geographic Profiling.
Key Concepts Redefined

Amongst the key theories within Environmental Criminology, Pattern Theory encompasses explanatory capabilities regarding the findings of this study. Brantingham and Brantingham (1993a) explain that the likelihood of a criminal event occurring reflects the extent to which the environmental backcloth, the crime site location, the offender's readiness level, the routine activity patterns of both the offender and victim and the distribution of targets in space and time conjoin in a manner that is conducive to the successful commission of a crime. As such, Pattern Theory emphasizes that beneath the seeming complexity within which criminal events occur, there exist discernible patterns; one of which is the proclivity of criminals to select targets in close proximity to frequented activity nodes. Within the aforementioned equation of the criminal event, this study addresses the issue of the crime site location and the distribution of targets in space. It is the goal of this chapter to shed light on how the research in this study demonstrates the key concepts and phenomena within these two factors of the equation. First, a return to such concepts and their place within Pattern Theory is required.

According to Pattern Theory, one of the factors affecting crime site location is the offender's crime template; within that is the concept of the target template (Brantingham and Brantingham, 1993a). The crime template is the
offender's perception of what constitutes a 'good target' as well as the aspects of the crime that may be attributed to its success (e.g., the time at which it occurred). The crime template may be viewed as being similar to a cognitive script which the criminal can follow repeatedly. The extent to which a crime template solidifies perceptually and endures depends on the success of the crime itself. The target template specifically refers to the type of target deemed desirable. Brantingham and Brantingham (1991, 1993a) explain that the crime site location can vary as a function of the target template of the offender. For example, if the target is uniform in nature (equally available spatially), the crime site location is likely to be in close proximity to frequented activity nodes, such as the residential location. If the target is non-uniform (in specific locations only) the spatial distribution of the crime sites may be more dispersed. The differences seen in the average distances traveled to crime scene for the single time vs. serial arsonists is believed by the researcher to be predicated on the dichotomy of a target template, however, this will be discussed in the next section.

Along the same trajectory, the concepts of awareness space, activity space, activity nodes, buffer zones and the distance-decay phenomenon are key concepts towards discerning the unequal 'distribution of targets in space' and as such are integral to the criminal event equation held by Pattern Theory. The awareness space is defined as a person's general knowledge of an area in which they reside that includes their primary activity nodes, which are locations frequented daily within one's routine activities such as a residence, work or school (Brantingham and Brantingham, 1991). The activity space is explained to
be the central area encompassing the frequented activity nodes and travel routes between those nodes.

Lastly, the concepts of distance-decay and buffer zones became integral aspects of this study; thus, their salience within Pattern Theory will be revisited before the discussion of these findings. When looking at the spatial distribution of criminal activity, it is often seen that the proportion of crimes committed will decrease as the distance from primary activity nodes of the offender increases (Brantingham and Brantingham, 1981; 1991; Alston, 1994). This is known as the distance-decay phenomenon. Criminals appear no different from non-criminals in that target selection decisions are predicated on the least effort principle (Rossmo, 1994); why go further than necessary to get the job done? The exception to this rule, in a criminal context, is the phenomenon of the buffer zone, referred to as the 'avoidance zone'. Brantingham and Brantingham (1981) suspected that even though criminals select targets within their awareness space, they are unlikely to engage in target selection within the immediate vicinity of primary activity nodes, perhaps out of fear of detection.

'Distance Traveled' and Arson Activity

This study showed that the distances travelled within the target selection processes of arsonists varied in a consistent manner as a function of whether the arson was a one-time occurrence or part of a series of fires. The difference in the average distance travelled from the residential location between the two samples was found to be statistically significant. The average distance travelled for the single time arsonist sample was 3.38 km with a standard deviation of 3.56
km. The average distance travelled for the serial arsonist sample was 1.5 km with a standard deviation of 2.05 km. Thus, serial arsonists appear to select targets in closer proximity to their primary activity node of residence and exhibit a smaller spatial dispersion in the distances travelled, compared to the single time arsonists. This disparity is made increasingly apparent if one recalls that approximately one quarter of the single time arson cases (28%) as opposed to over one half of the serial arson cases (57%) exhibited target selection patterns within 1 km or less from the residence of the arsonist. Specifically, only 13% of the single time arsonists chose targets 0.5 km or less from their home versus serial arsonists who lit fires within this distance interval 43% of the time. Additionally, it was shown that the single time arsonists favoured further distances disproportionately compared to the serial arsonists. Specifically, 37% of the single time arson cases involved a target selection process 3 km or greater from the residential activity node. Only 8% of the serial arsonists travelled as far.

It is believed by the researcher that a potential explanation for the differences in the distance travelled between the samples may be predicated on the frequently cited dichotomy of instrumental vs. expressive crimes. Promising research on this topic regarding the crime of arson has been conducted in the U.K., as discussed in Chapter Two. The findings from those studies will be revisited as they encompass potential explanatory capability towards the results in the present study.

Canter and Fritzon (1998) assessed 175 cases of solved arsons in England to see whether a relationship existed between the actions of the
arsonists during the commission of the crimes and their motivations for the arsons. The sample included offenders convicted of only one arson and repeat arsonists. The researchers found strong support for their hypothesis that the mode of fire setting was related to the arsonist’s characteristics. Specifically, four modes of arson behaviour were established from the case files; expressive person (an attempt to restore emotional equilibrium or seek attention), expressive object (an intrinsic fascination for fire; emotionally charged event with a non-specific trigger), instrumental person (a direct result of some form of dispute) and instrumental object (often committed by young people; opportunistic rather than selective). Canter and Fritzon found a significant correlation between the mode of behaviour, during the arsons, in the expressive object category and being a repeat arsonist; the serial arson behaviour seemed to be the manifestation of a fascination with fire or a by-product of emotional pathology devoid of specific triggers. There also existed an association between the mode of instrumental object and the variable of ‘young offender’. Thus, the young arsonist in the study was associated with arsons that were committed in groups where the target was more opportunistic than selective in nature. Additionally, when looking at all of the arsonists in total, at least 60% of the arsons occurred less than 1 mile (1.6 km) from the offender’s home. The study demonstrated an association between the characteristics of an arson offence and the offender’s personal characteristics and that arson, particularly serial arson, often entails psychological origins.

Fritzon (2001), as discussed in Chapter Two, conducted another study in the United Kingdom looking at the average distance travelled by arsonists from
home as a function of four behavioural categories of the arsons. The study assessed 156 cases of solved arsons in England. From the case files, four behavioural categories of despair (expressive action directed at a person), display (expressive and attention seeking), damage (targeted at properties with instrumental gain) and destroy (a planned attack against a specific person) were amalgamated into two categorical variables representing instrumental vs. expressive arsons. The category of instrumental arsons included the damage and destroy behaviours whereas the expressive arsons involved the display and despair behaviours. The basis for the dichotomy between expressive vs. instrumental arsons largely depended on whether the arson was impetuous in nature; served to fulfil an emotional need (expressive) or was purposive in nature targeting specific properties or persons possibly due to a dispute or for financial gain (instrumental). In the previous study conducted by the same researcher, it was found that the repeat or serial arsonists exhibited behaviours likely to fall into the expressive arson categories as opposed to the instrumental category.

Interestingly, there existed discernible patterns between the behavioural categories of the arsonists and the average distances travelled from home to the crime scene. The arsonists exhibiting behaviours indicative of expressive behaviours travelled an average of 0.56 km (despair) and 0.54 km (display) (Fritzon, 2001). The arsonists categorized as instrumental in nature travelled much farther on average: 2.11 km (damage) and 6.24 (destroy). When combined, the average for the instrumental arsonists was 1.57 km and 1.91 km for the expressive arsonists.
The proposition that the discrepancy in distances travelled to crime
scenes by arsonists may vary as a function of the behavioural category of the
offender is a useful approach towards explicating this phenomenon. The
researcher believes that the results obtained in the aforementioned studies may
hold explanatory capabilities regarding the statistically significant difference seen
in the distances travelled between the single time versus serial arsonist samples
in the Greater Vancouver Region of B.C. From the two studies originating in the
U.K., two salient patterns emerge regarding the spatial dynamics of arson
activity. One, that serial arsonists are highly likely to exhibit offending patterns
indicative of expressive crimes where the fires represent a manifestation of an
emotional imbalance and that the arsons often occur in the absence of a specific
trigger. Second, those arsonists whose offences were categorized as expressive
in nature travelled shorter distances from their homes to the crime scenes and
exhibited a strong proclivity to remain within their awareness space when
selecting targets. It is the opinion of the researcher that from these patterns two
additional propositions may be inferred with respect to arson activity. One, if
serial arsonists often exhibit behaviours of expressive crimes, then it may be
argued that the arsonists setting fires only once (single time arsonists) are likely
to be the offenders found in the instrumental crime category. Second, if it is the
case that serial arsonists exhibit strong proclivities to remain close to home when
offending, then it may be argued that the single time arsonists are likely to be the
offenders who travel farther distances.
Despite the fact that the present study did not systematically record and analyse the motivations of each arsonist, it is believed by the researcher that the single time arsonists may be characteristic of the *instrumental* crime category whereas the serial arsonists; indicative of the *expressive* crime category. Based on this projected dichotomy, the statistically significant difference seen between the two samples regarding the average distances travelled becomes explicable if one considers a secondary dichotomy between the target templates as part of the environmental backcloths of the arsonists. The single time arsonists may have travelled further on average due to a *non-uniform* target template. The term 'template' must be used with caution in this context as it usually refers to a cognitive perception developed over time through experience. This definition is imprecise in its extension to the single time arsonist sample as it is assumed they have only committed arson once. However, it is proposed by the researcher that the single time arsonists in this study committed their crimes for tactical purposes most likely premeditated in nature and as such encompassed a specific target that may not have been within the vicinity of what would constitute their awareness space. For example, the single time arsonist may have been targeting a former employer's business or an ex-boyfriend's residence; such locations are specific in nature and may have been located outside of the vicinity of the offender's frequented activity nodes. Thus, the target in such situations is non-uniform in that it was not equally available in a spatial context. The single time arsonists may have had to travel further distances to carry out a specific fire-
setting goal; this renders the crime instrumental in nature and may explain the larger distances travelled on average by the arsonists in this sample.

Another potential explanation for the larger distances travelled on average by the single time arsonist sample may lie in the origin point used for the distance measurements. In this study, the primary activity node from which the distance to crime scene variable was measured was the residential location of the offender. It is possible that the arsonists in the single time sample were travelling to set fires from other activity nodes, other than their homes that were located closer to the crime site than that of the residence. It is known to the researcher that certain cases in the single time arsonist sample involved more than one offender being charged with one arson; thus, it may be the case that groups of persons met and travelled to the crime scene together from one offender's activity node that was closest to the crime site. Wiles and Costello (2000) discovered upon interviewing burglars that the origin from which they travelled to the crime scene was not always their residence, rather another frequented activity node such as their girlfriend or parent's home. These origin points turned out to be closer to the crime site, rendering the distance measurements from the offender's residence as overestimations. Thus, it may be the case that the single time arsonists, on average, travelled from other activity nodes (not known to the researcher) that were in closer proximity to the crime scene in comparison to their residence; the average distance travelled of 3.38 km may be an inflated calculation.
The arsons in Fritzon’s (2001) study that were categorized as expressive involved offenders travelling shorter distances to the crime scenes. These arsons were cases where the expressive act was directed at a person or the seeking of attention from family or Law Enforcement. Canter and Fritzon (1998) previously found that the expressive arsons were often linked to the repeat arsonists in their sample. As such, it is the argument of the researcher that the serial arsonists in the present study may exemplify those of Fritzon’s expressive arson category; and that this distinction may explain why the sample exhibited the distance-decay phenomenon in such a clear manner, if one once again considers the target template of the serial arsonist. Some of the serial arsonists in the present study encompass characteristics indicative of the expressive, repeat arsonists in Canter and Fritzon’s (2001) study. The Vancouver Serial Arsonist was known anecdotally to the VPD as being a ‘pyromaniac’ who set fires for thrills and perhaps sought attention from Law Enforcement. The Burnaby Serial Arsonist set fires distinctly for attention seeking purposes; perhaps explaining her lack of vigilance in offending within 50-meters of her residence in her final series of arsons. Thus, if it is assumed that the serial arson cases in this study fall into the category of expressive crimes, it may then be proposed that the target templates of the serial arsonists were likely uniform in nature; equally available spatially. This is because in the case of an expressive arson involving a serial offender, the target is not the focus of the behaviour; rather, it is the behaviour itself of setting fires that may fulfil the desire for excitement or obtain attention (Canter and Fritzon, 1998; Fritzon, 2001). As such, the target template
of the serial arsonist is more likely to be uniformly available spatially, because as the saying goes, “anything will do”. With a uniform target template, the serial arsonist would not have to travel further than necessary to set the fires; when one has unlimited choices, decisions are often predicated on minimizing effort while maximizing results. This would be synonymous with Fritzon’s (2001) finding that the arsonists in the ‘despair’, expressive category exhibited the distance-decay phenomenon most strongly with psychological ties to their home area when selecting targets. It is held by the researcher that a uniform target template of the serial arson offenders in the present study may be a potential explanation for the shorter distances travelled to the crime scene on average as well as the visible distance-decay phenomenon exhibited by this sample.

Another similar finding of the present study to that of Canter and Fritzon’s (1998) study was the proportion of young offenders committing the instrumental versus expressive arsons. A strong association existed in the U.K. study between being a young arsonist and the offence being categorized as instrumental in nature; specifically instrumental object. Likewise, the present study found a much larger proportion of young offenders in the single time arsonist sample (likely characteristic of instrumental crimes) with 43% of the sample aged between 12 and 17 years versus only 17% in the serial arsonist sample.

The category of total arsonists, encompassing the combined distance measurements of both samples, demonstrated an average distance travelled from the residence of 2.17 km; the median distance was 1.17 km. Even in light
of the larger average distance travelled with the single time arsonist sample, the
distances travelled for all arsonists combined in this study is indicative of a target
selection process favouring the awareness space of the offender and the
distance-decay phenomenon. For example, 46% of all arsonists in the study
tavelled 1 km or less from their homes to set fires whereas only 19% travelled 3
km or greater. Figure 51 illustrates that for all the arsonists in the study, the
target selection process begins approximately 0.5 km from the residence of the
offender and as the distance increases from this origin point, the proportion of the
arsons decrease. These patterns are consistent with the findings of two key
studies previously discussed. When looking at all of the arsonists in the sample
together, Fritzon (2001) found that the average distance travelled from residence
to crime scene was 2.06 km. Sapp et al. (1998) demonstrated that 70.3% of the
serial arsonists analysed travelled 2 miles (3.2 km) or less from their homes to
set the fires. Therefore, the findings in the current study appear to corroborate
the research of others regarding the spatial target selection processes of
arsonists.

A key question to address is: What do the findings contribute to further
understanding the spatial aspect criminal behaviour? It is the opinion of the
researcher that the results shown in Figures 51 and 53, for example, lend
credence to key components theorized by the Brantinghams in Pattern Theory
and as such augment previously existing literature in the field of Environmental
Criminology, specifically in regard to arson activity. In focusing on the total
arsonist sample, Figure 51 reveals that the target selection process is most
prevalent within a 2 km radius from the arsonists' residential activity node. This pattern offers strong support towards the salience of the awareness space in target selection decisions that demonstrates the strong proclivity for criminals to offend within areas perceived as familiar and perhaps predictable. The current study suggests that within the crime template of the offender, the awareness space is perhaps the most cogent element determining where an offender selects his/her target; it is argued as being even more salient than the target template itself. This is inferred from the finding of this study that whether the arsonist's target template was considered uniform or non-uniform in nature, there existed an overall propensity to remain within close proximity to the residence. Even if one accepts the proposition of the researcher that the target template of the single time arsonists was non-uniform in nature, Figure 52 nevertheless reveals that 63% of these cases involved distances travelled of 3 km or less from the residence of the offender; 81% of all cases in the study exhibited the same spatial pattern. Thus, the present study's results for arsonists lend strong support towards the inclusion of the awareness space phenomenon in attempting to explain the spatial aspect of criminal target selection.

Arguably the most salient finding of this study was the repeated absence of target selection within a 250-meter radius from the serial offender's residence. Figure 55 demonstrates almost no arson activity within the first 150-meters from the serial arsonist's homes with a significant increase in target selection once the arsonist travelled more than ¼ km from that origin point; evidencing the 'avoidance zone'. With regard to the single time arsonist sample, the minimum
distance travelled from home to crime scene was 0.08 km or 80-meters. This indicates that the phenomenon of the avoidance zone may have been a salient factor within the spatial patterns of single time arsonists as well as none of the cases exhibited target selection within a 50-meter radius from the offender's home.

The findings of this study offer concrete support that the phenomenon of the avoidance zone not only exists but also is a salient part of the crime template and the target selection process itself. Specifically, only 3% of the serial arsons occurred within 50-meters of the offender's residence and only 16% of the cases involved a target selection process within a ¼ km or a 250-meter radius from the central activity node of the residence. Figures 14, 32, 36, 42, 46 and 50 somewhat demonstrate the phenomenon of the avoidance zone as well as the distance-decay pattern, initially proposed in Brantingham and Brantingham's (1981), "Notes on the Geometry of Crime". In that paper, the search area for an individual offender with a uniform distribution of targets, engaging in target selection from home was depicted as nonexistent directly adjacent to the home; increasing as the distance from the home concomitantly increased, and then decreasing as the distance ventures away from the offender's awareness space. The serial arsonist’s search area in the current study resembles this theoretical pattern (as shown in the aforementioned Figures) and as such lends credence to the validity of such phenomena within the Brantingham's model of crime site selection (1981).
The arsonists in this study exhibited very specific spatial patterns within their target selection processes. Specifically, the arsonists showed a repeated propensity to select targets within the distance interval of 250-meters to 2 km from their residential activity node. This pattern connotes a criminal range within which arsonist target selection occurs from the primary activity node of the residence. Target selection occurring at distance intervals smaller or greater was rare, particularly with the serial arsonists. Within the field of Environmental Criminology, the crime of arson is little discussed in literature focusing on the spatial dynamics of criminal activity. It is hoped that this study will augment previous literature in the field that focuses on such variables with offenders of other crime types. Thus, it is at this time that the results from this current study on arson activity will be compared to previously discussed literature in the field with regard to the distances travelled to crime scenes by offenders of crime types other than arson.

**Target Selection Patterns of Arsonists vs. other crime types**

This section will proceed to compare the results found in this study with those of others previously discussed regarding the spatial target selection processes of criminals involved in various crime types.

As early as 1856, Glyde found that criminals in general were not offending directly within areas adjacent to their residences; rather, were travelling just outside of such areas to commit their crimes. It appears that the phenomenon of the avoidance zone exhibited by the arsonists of this study has
been a pervasive and enduring aspect of the target selection processes of criminals.

More recently, Alston (1994) conducted a study assessing the spatial patterns of serial rapists in the same geographical areas of focus in the current study (Greater Vancouver Region of British Columbia). Specifically, it was found that 58% of the rapes occurred within 2.5 km of a primary activity node of the offender and 97% of the rapists selected victims 3.5 km or less from a routine pathway in their awareness space. It is interesting to note that the current study of arsonists found comparable results to Alston's (1994) serial rape sample and that the areas in question are similar; the Greater Vancouver Region: 76% of serial arsonist cases involved target selection at 2 km or less from the home of the offender.

Further support for the analogous target selection processes of rapists and arsonists is found within Warren et al.'s (1998) study in that almost half of the serial sexual offenders raped at least once within 0.5 miles (0.8 km) from their homes. Additionally, the serial rapists primarily avoided areas within or immediately surrounding their residence, yet favoured areas in the second distance interval. The results of the serial rapist target selection patterns resemble those of the serial arsonists in the current study. The serial arsonists exhibited similar target selection processes in avoiding areas immediately adjacent to their residences, yet chose the majority of their targets within a 0.5 km radius (43%) from the same location.
Canter and Larkin (1993) examined forty-five sexual offender's spatial activity within British male assaulters who had committed at least two assaults. As with the present study, a separate map was produced for each case indicating the rapist's home base and crime site locations. The research attempted to shed light on whether a general model can be developed that is applicable to any individual offender's spatial activity. Two models were explored in analysing the criminal spatial range of rapists, the commuter and marauder hypotheses. Canter and Larkin found that forty-one out of the fifty-five offenders exhibited criminal ranges that surrounded their home base. A very high proportion of rapists targeted their victims within close proximity to their residential location and as such, support for the marauder model of criminal spatial movement was demonstrated. Thus, the study found that rapists were more likely to remain in an area encompassing their home base (marauders) rather than travel outside of their activity space when selecting targets (commuters). The average distance travelled from home for this sample was 1.53 miles (2.44 km). Most interesting though was the discovery of a 'safe area', which referred to a minimum distance travelled from home from which target selection would ensue. The safe area, which was devoid of criminal activity within the spatial offending patterns, was 0.61 miles (0.98 km). This phenomenon is synonymous with the 'avoidance zone' discovered in the present study; however the arsonists seem to begin their target selection process in closer proximity to their homes as the minimum distance travelled by the majority of the serial arsonists was approximately 0.25 km. Canter and Larkin's (1993) study of rapists offers support towards the
existence of a criminal range; however, it appears that the arsonists in Greater Vancouver extend their target selection across a larger geographical range than the serial rapists assessed in Britain. This finding may be related to logistical differences within an urban setting that have ramifications on travel patterns to crime scenes; there may be more cars per capita in Greater Vancouver with more people driving and travelling farther distances; or simpler street networks in Greater Vancouver may have provided easy manoeuvring for the arsonists through the city while selecting targets. Such hypotheses depend on the mode of travel- whether the arsonist travelled by car, on foot or with public transit. Nonetheless, Canter and Larkin's study corroborates the findings of the present study with serial arsonists in that a very specific distance interval often defines the criminal range. Canter and Larkin (1993) suggest that such findings may be indicative of a general model applicable to an individual offender's spatial activity. In light of the repeated pervasiveness of this spatial phenomenon within the present study, this researcher agrees with Canter and Larkin (1993). It appears that upon assessing the spatial activity patterns of serial target selection in general, a specific geographical range exists in which offenders select the majority of their targets, a pattern appearing to traverse many crime types. The criminal range of the arsonists in this research study appears to be within 0.5 to 2 km from their homes.

Wiles and Costello (2000) assessed crime data for the city of Sheffield and for North Yorkshire regarding burglaries and found that the average journey from the offender's residence to the crime site was 1.88 miles (3.0 km) in
Sheffield and 0.98 miles (1.57 km) in North Yorkshire. Additionally, the researchers were able to corroborate the police data with offender interviews. The interviews shed light on the fact that the offenders often were not travelling from their residences when committing the crimes, rather from other activity nodes such as a girlfriend's house. In fact, from the offender interviews the average distance travelled for the burglaries in Sheffield decreased from 1.88 miles to 1.6 miles (2.56 km). The current study was unable to corroborate the police database information with interviews; however, it is apparent that the average distance travelled to crime sites for the burglars in Sheffield and the arsonists in Greater Vancouver is particularly analogous; 2.56 km travelled on average for the burglars and 2.17 km for the arsonists in the current study. Thus, the research examining the distances travelled to crime scenes offers overwhelming support for the existence of the awareness space in the target selection process; whether the offender commences target selection from his or her residence or from other frequented activity nodes; criminals do not travel far in their search for targets.

Lastly, the results obtained by Van Koppen and Jansen's (1998) study on the spatial offending patterns of robbers in the Netherlands in 1992 are both analogous and disparate to those obtained regarding arson patterns in the current study. Van Koppen and Jansen established that if the robbery occurred within the offender's individual range, the crimes were dispersed almost randomly. Such results may be indicative of the robber selecting targets within a non-uniform awareness space while encompassing a uniform target template. If
the target selection process occurs inside the awareness space of the offender it is not unlikely that the spatial distribution of crime site locations would appear random in nature. The offender is familiar with that area and if the target template is uniformly available spatially, the offender would not perceive any spatial parameters within the search process of that area. It is the opinion of the researcher that the spatial distribution of arson locations for many of the cases in the present study are indicative of such a random dispersion established by Van Koppen and Jansen's study. For example, in returning to Figures 8 (first series of Vancouver Serial Arsonist) and 11 (second series), the visualizations suggest that the arson locations exist within the offender's awareness space and appear to be randomly located in that area. Figure 28 shows the fifth series of the Burnaby Serial Arsonist and those fourteen arsons also appear to be randomly dispersed within the vicinity of her residence. Thus, with regards to the serial arson cases and the results shown by the robbers in the aforementioned study, it may be inferred that in the presence of a non-uniform awareness space and a uniform target template, the distribution of crime site locations is likely to appear spatially random and that this pattern may be attributed to the target selection occurring within an area constituting high levels of familiarity, perceived predictability and confidence in the probability of success in the commission of the crime.

The distances travelled by the robbers in Van Koppen and Jansen's (1998) study did not vary significantly as a function of 'preparedness'; the robbers who claimed to have planned their crimes travelled similar distances to the crime
scene in comparison to the more impetuous robbers. It is the opinion of the researcher that these results may be disparate to those found in the current study. The average distance travelled to crime scenes by the single time arsonist sample was found to differ at statistically significant levels in comparison to the distances travelled by the serial arsonists. It is held that the single time arsonists were far more likely to have planned their crimes in advance as the arsons were likely tactical and purposive in nature as opposed to the serial arsonists whose crimes were more likely random and impetuous in nature. Thus, the results in the current study do not seem to resemble those of Van Koppen and Jansen’s if one equates a single time arson occurrence with a level of premeditated preparedness.

Lastly, it is imperative to reiterate that the findings of this study demonstrate both contrasting and comparable spatial patterns between those setting fires once vs. serial offenders. It was shown that there exists a statistically significant difference between the average distances travelled from the residence to the crime scene depending on whether one engages in arson as a one-time occurrence or in a serial fashion. Serial arsonists select targets within a smaller vicinity and do not exhibit as much spatial dispersion in the distances travelled as single time arsonists do. However, both types of offenders exhibited a strong proclivity to remain close to home and within their awareness space when selecting targets. Thus, it is the stance of the researcher that the findings suggest that encompassing a non-uniform target template (as perhaps with the single time arsonists) may propel an offender to travel further distances than
normally expected; however, the tendency to favour areas close to primary activity nodes surpasses the target template in importance within the target selection process and the distribution of targets in space.

Appendix B lists the targets of arson documented for each sample. The number of targets listed is fewer than the number of arsons examined for the spatial analysis. This is due to the fact that the target information is not always available through police databases for various reasons; the police officer attending the scene may not have documented the target type in their report, or it may be due to an error of omission within the data entry process itself. However, in focussing on the cases in which the target information was available, there do not appear discernible differences at first glance. Both single time and serial arsonists set fire to both residential and commercial buildings and vehicles and various detached objects such as shrubs or dumpsters. It is interesting to note, though, that the serial arsonist's targets exhibited far more residential buildings than the single time arsonists. In the single time arsonist sample, there are more commercial or public buildings targeted (e.g., public washroom, high-school, and hotel room). The primary question is why would serial arsonists target residences more often than the single time offenders? Explanations for this finding would likely be predicated on the motivations behind the arsons, which were unknown to the researcher.

Policy Implications

As mentioned in Chapter Two of this study, one of the most prominent applications developed from research in the field of Environmental Criminology is
that of Geographic Profiling. Pattern Theory holds that if a criminal encompasses a non-uniform awareness space and is attracted to a uniformly available target, his or her victim/target sites will be in close proximity to his or her primary activity nodes within the awareness space (Brantingham and Brantingham, 1993a). Geographic Profiling reverses this proposition and poses the question, if the crime site locations are known, can one predict the approximate locations of the offender's primary activity nodes? It appears that Geographic Profiling yields a high level of reliability in answering this question and can offer police investigators invaluable insight into the area in which a serial offender may be residing (Alston, 1994; Rossmo, 1994; 1995). The utility of the method increases with a larger number of location points. It is the opinion of the researcher that Geographic Profiling techniques are of immense utility to serial crime investigators when a suspected serial arsonist may be at work and where circumstances lead to the linking of five or more fires to one suspected perpetrator.

Geographic Profiling functions on the premise that when a serial criminal encompasses a uniform target template, the crime sites are likely to be in close proximity to the residential location of the offender, due to research exhibiting the distance-decay phenomenon and the least effort principle (Rossmo, 1994). This study illustrates two phenomena that are integral components in the theoretical basis of Geographic Profiling and as such lend significant credence to both the theory behind Geographic Profiling and the use of such techniques in serial crime investigations. First, as mentioned before, the existence of the awareness space
in serial arson target selection processes was consistently present. For example, with regards to the serial arsonist sample, the most frequently documented distance interval utilized by these offenders in their target selection process was 0.5 km or less from the central activity node of their residence. A total of 76% of the serial arson cases occurred within 2 km or less from the offender's home at the time of the series. This study demonstrated that each serial arsonist evidenced a proclivity to select targets within their awareness space close to the primary activity node of residence. These patterns offer strong support towards the utility of Geographic Profiling; additionally it supports the use of such techniques for Law Enforcement practices in narrowing down the vicinity within which a suspected offender may be residing.

Secondly, this study demonstrates a very specific distance interval favoured by serial arsonists in their target selection processes; equally as interesting was the absence of the residential location within that distance interval. It was shown repeatedly that serial arsonists prefer to set fires beginning approximately 250-meters from home and continuing to approximately 2 km thereafter (see Figure 55). This finding holds significant utility to Law Enforcement with the application of Geographic Profiling in the case of suspected serial arsonists. A Geographic Profile may indicate the vicinity within which an offender's residence may be located; this study additionally offers an investigative warning to Law Enforcement that the sought after residential location is unlikely to exist within ¼ km from any given arson location.
Additionally, this study indicates that in the case where the arson locations appear randomly located within a small area that a serial arsonist encompassing a uniform target template may be at work. It is when the arson locations appear non-random and targets non-uniform that either a single time offender has likely committed the crime or a serial arsonist is travelling outside of his or her current awareness space to set the fires. An example of the latter in the current study was the third and fourth arson series of the Burnaby Serial Arsonist. Upon assessing the point pattern maps, it appeared as if her spatial offending patterns were non-random (i.e. purposely seeking out specific areas) as the arson locations were dispersed across two jurisdictions. However, upon further assessment, it was learned that the arsons remained in close proximity to her former residential activity nodes and were in fact more reflective of a random target selection process within former awareness spaces. Yet for Law Enforcement Investigators at the time of those series', a Geographic Profile would not have aided in narrowing down the vicinity of her residential area at the time of those series as she was favouring neighbourhoods outside of her current activity space.

Although the present study did not assess the distances between arson locations as analysis focused on distances between offender residence and arsons, it may be noteworthy to return to the point pattern maps showing the spatial distribution of arson locations per jurisdiction for each sample. This is due to the researcher's belief that visually, the arson locations in the single time cases appear farther apart than the arsons in the serial sample cases. This
visual pattern may be worth further examination to discern whether the distances between arson locations (within a jurisdiction) linked to single time offenders versus serial offenders are significantly different. If it is the case that the difference in the spatial distribution of arson locations themselves is statistically significant (as the average distances travelled from residence to crime scene between the two samples was) between such samples, the finding may have implications for linkage analysis within investigations. For example, in comparing the spatial distribution of arson locations in Figure 2 (single time arson cases for Vancouver) to those of Figures 8 and 11 (Vancouver serial arsonist cases), the spatial dispersion appears far greater in the former point pattern maps than in the latter two. It is the belief of the researcher that if these distances were systematically analysed, that the averages between samples would differ at statistically significant levels. From such findings, it would be possible to suggest that if suspected arson locations are, for example, 1 km or less from one another, they are likely to be linked and the work of one serial arsonist. Concomitantly, if suspected arson locations are, for example, more than 3 km from one another, it may be possible to infer that they are unlikely to be the work of one serial arsonist and are more likely unrelated cases of possible single time offenders.

Such research would have direct implications for the utilization of Geographic Profiling in suspected serial arson cases. If research can identify a spatial pattern between crime site locations indicative of serial offending (as opposed to unrelated single time offences), it would then aid Law Enforcement in determining whether to implement the techniques of Geographic Profiling as one
of the tools used in the Investigation. Due to the fact that the current research project has shown that serial arsonists reside in very close proximity to their targeted locations, research going one step back that would allow Investigators to infer linkage between suspected arson cases would validate the use of Geographic Profiling techniques in such circumstances and potentially expedite identifying the residential area of the arsonist.

As a final point with regard to policy implications, it is suggested by the researcher that the current study demonstrates the potential value of neighbourhood and video surveillance when a suspected serial arsonist is at work. This study shows that if fires occur in a specific area and the targets are uniform in nature, it is likely that a serial arsonist is at work and that he or she is favouring the area due to their level of familiarity and is likely to re-offend within the vicinity of where the fires are currently occurring. Thus, it is the suggestion of the researcher that neighbourhoods implement group surveillance teams that work in shifts during the time period of which the fires seem to be occurring and attempt to make their presence known in the area. Additionally, if a series of fires are clustered in a finite location (e.g., an underground parking, public park or washroom facilities) it is the suggestion of the researcher that Law Enforcement utilize video surveillance methods in order to record any suspicious activity. These suggestions fall under the category of crime prevention and stem from the visual finding that serial arsonists select targets within very specified distance intervals, repeatedly setting fires in locations of close proximity to one another.
Thus, it may be possible through such surveillance techniques to witness or capture on video a potential suspect.

**Future Trajectories in Spatial Analysis Research**

This section will suggest methods and areas of future research in assessing the spatial attributes of criminal activity.

In regard to the results obtained with the serial arsonists in this study, it would be advantageous to replicate the research using a larger sample across Canada and in the U.S. to verify the reliability of the spatial patterns found. It would be interesting to conduct a comparative analysis of the spatial patterns of serial arsonists between Canada and the U.S.; if analogous results were found it would lend credence to the pervasiveness of the awareness space and avoidance zone in the target selection process of serial criminal activity.

Additionally, conducting qualitative research with charged serial arsonists would be of great utility, as it would aid in determining whether the use of the offender’s residence is an accurate origin point from which distance measurements are often made. The frequency of use for activity nodes such as work, school and frequented friend’s homes is not as well known. It would be interesting for the researcher of this study to interview the serial arsonists included in the present analysis in order to corroborate the assumption that they were commencing their target selection process from their respective residential locations; or whether they were travelling from alternative activity nodes. The problem arises with this assumption that the residence is the only activity node
which target selection initiates from. This was demonstrated in Wiles and Costello’s (2001) study; upon corroborating the data obtained from police records of burglars with offender interviews, it was established that the initial distance measurements taken from the burglar’s residence were overestimates as the target selection process occurred from other activity nodes located in closer proximity to the crimes compared to the offender’s residence. Thus, it should be highlighted that the distance measurements on which this study is based must be viewed as tentative representations of the target selection processes of arsonists and the study itself, exploratory in nature.

Tangentially to further discerning the spatial patterns of the criminal range, it is suggested that additional research may want to concentrate on assessing the areas in which arson activity occurs. Such research would necessitate a change in focus from a micro-spatial analysis to a meso-spatial analysis. This would involve aggregating the arson locations into a polygon on a choropleth map; not concentrating on where the arsons are occurring in relation to where the offender resides, rather, focusing on the attributes of the areas demonstrating arson activity. Thus, the foci of the study moves from a micro-spatial analysis of the individual arsonist’s target selection process to a meso level, spatial auto-regressive analysis. The crime of arson is largely exempt from aggregate spatial-statistical analyses and research is needed to discern the attributes associated with the spatial distribution of this crime type in Greater Vancouver to ascertain if clusters of arson activity exist. If clusters of arson activity appear, it would be imperative to explore the categorical or demographic variables of such
areas in order to generate explanatory hypotheses regarding the non-random arson occurrence.

Pettiway (1988) conducted a spatial study on arson in Texas and found that specific demographic variables of certain areas were positively correlated to the arson rate such as the percentage of older housing units, minority populations and external migrant populations. Stahura and Hollinger (1988) found that criminal motivation (e.g., unemployment rates) was most highly predictive of increases in suburban arson rates. What is absent from such studies is the spatial-statistical component; it is the opinion of the researcher that future studies may want to begin with a spatial intensity analysis to ascertain where arson is occurring in a city and progress with tests of complete spatial randomness to assess how intense any spatial clustering of arson activity may be. The spatial patterns shown in the current study have indicated that arsonists like many offenders, favour areas and targets that are in close proximity to both major travel routes and public venues. For example, the Burnaby serial arsonist committed many of her arsons on and around major street networks in the jurisdictions of Burnaby and New Westminster. From the visualizations it appears that these locations may have been close to skytrain stations in the area (primary transit activity nodes) and to Metrotown, a popular shopping complex in Burnaby. Thus, aggregate spatial analyses on arson ought to include not only major roads and highways as themes within choropleth maps, but transit routes and major activity nodes of public venues within the city. It is hypothesized that such an analysis would result in the knowledge that arsonists select targets that
are in close proximity to major activity nodes and travel paths routinely frequented within their daily activity patterns in addition to their residence. It is only after an exploratory spatial data analysis is conducted that a spatial regressive analysis is of primary use towards a further discernment of explicative variables related to increased arson rates in certain areas and concomitant suggestions towards future crime prevention of such an offence.

Lastly, the discourse on the existence of the awareness space in the distribution of criminal targets occurs primarily on a theoretical level. Research, such as the current study, has succeeded only in providing strong indications through visual representations that the awareness space is a cogent perceptual factor in the criminal mindset when embarking on the target selection process. Thus, its existence has been written about theoretically (Brantingham and Brantingham 1993a) and corroborated only on a visual (Rossmo, 1994, Alston, 1994; Canter and Larkin, 1993) and anecdotal level. It is the opinion of the researcher that a methodology needs to be developed that would systematically evaluate the existence of the awareness space in a manner that would substantiate its validity and reliability. This ought to begin with non-criminal populations and would most likely entail the development of a psychometric instrument, as the awareness space exists on a perceptual or cognitive level, though manifested spatially. If it were possible to corroborate the existence of the awareness space psychologically, it would then be advantageous to assess its salience within the criminal target selection process. Such an undertaking would entail numerous methods from psychometric tools, to interviews, to spatial-
statistical analyses. It is held by the researcher that validating the proposition that criminal target selection processes are governed by the existence of a spatial-cognitive parameter in the offender's mind necessitates a multivariate methodology and that such an effort is worthwhile considering the repeated prevalence of research indicating that this phenomenon is as salient empirically as it is theoretically. Research in the area of Environmental Criminology has not, as of yet, statistically measured the psychological existence of this spatial-cognitive phenomenon or its magnitude in the decision-making processes of serial criminals. To date, the salience of the awareness space within the field of Environmental Criminology has only been suggested or indicated through research; it is held by the researcher that a methodology ought to be developed that authenticates psychologically what appears to exist spatially.
January 9, 2004

Ms. Andrea Curman
Graduate Student
School of Criminology
Simon Fraser University

Dear Ms. Curman:

Re: A Spatial-Statistical Analysis of Arson Activity in the Greater Vancouver Region of British Columbia

SSHRC

The above-titled ethics application has been granted approval by the Simon Fraser Research Ethics Board, in accordance with Policy R 20.01, "Ethics Review of Research Involving Human Subjects".

Sincerely,

Dr. Hal Weinberg, Director
Office of Research Ethics
APPENDIX B

Single Time Arsonist Targets

inside of residence
newspapers on fire and stuck in a mailbox
front door of residence
attempted to harm himself via fire
Vancouver Sun newspaper stand
toaster at a bread garden
kitchen inside residence
rear garage of residence
hotel room
dumpsters
bathroom at Pacific Centre Mall
the road: poured gas and ignited it
plastic bag in a tree filled with marijuana
vehicle in underground parking garage
resident premises
wooden structure at race track
basement of residence
townhouse
set off flares by ocean and got boats on fire
hedge fire on property
high-school
bottle with gas and lit it and dropped on resident premises
public washroom
fire in alley
fire in alley
building fire
building fire
backyard bbq of residence
house fire
parent's residence
car
car
vehicle and house fire
property and fence on fire
school property
school property
fire started in kitchen of father's house
Molotov cocktail thrown at residence
a wooden ridge on fire
house fire
house fire
plastic tube in a playground
a bed in a residence
Serial Arsonist Targets

hedge in a back lane
intermediate care home
mattress inside a residential garage
tree next to a house
roof of a house
bush
house for sale
a rest home and vehicle
house
garage-residential
residential garage
hedge of a house
envelope lit and placed in commercial business
sign on door of office building
vehicle
residential area= fence, hedges, rubbish, container in lane, and blue boxes
sign on door of office building
roof of dwelling with exposure to the garage
rubbish container
porta potti at construction site
blue box set fire to in lane
rubbish container with exposure to shed, house and 3 vehicles
shrubs and fence behind concession stand at public beach
sign on door of commercial office suite
rubbish container
cedar hedge at rear of house with exposure to wood framed garage
exterior under porch of vacant house
residential- carpet
residential- carpet
residential- accelerant poured at rear entrance
residential- carpet
residential- carpet
residential- carpet
residential- carpet
residential- first step of stairwell
residential- foot of first step
fence of residence
residential- newspapers
dumpster in underground garage
residential- main stairwell
carpet at main entrance in residential building
home with stuffed animal doused with accelerant
residential- dish cloth
commercial- women's washroom at hotel
main floor of residential building

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Serial Arsonist Targets

couch set fire to in underground parking lot
main floor of hallway- residential building
Residential- stairwell
Residential- rear basement suite exit
residential- stairwell
residential- carpet
apartment building- carpet
rear stairwell of building
outside wall of apartment building- Molotov cocktail
residential-rear staircase
outside wall of apartment building
outside wall of apartment building
bottom of stairwell using lighter fluid- apartment building
apartment building- rear stairwell set fire to- DEATH OF ONE FEMALE RESIDENT
mattress
school bus
occupied house
unoccupied house
house fire
greenhouses
car at company location
REFERENCE LIST


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