# ANALYSIS OF THE BURGLARY PHENOMENA:

# PROBLEM SOLVING

# UNSPECIFIED TEMPORAL BREAK AND ENTERS

# IN THE CITY OF BURNABY

By

Greg Jenion

B.A., Simon Fraser University, 2000

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

In the

School of Criminology



SIMON FRASER UNIVERSITY

August, 2003

**APPROVAL**

Name: Greg Jenion

Degree: M.A.

Title of Thesis: Analysis of the Burglary Phenomena: Problem Solving Unspecified Temporal Break and Enters in the City of Burnaby

Examining Committee:

Chair: Brian Burtch, Ph.D.

Paul J. Brantingham, J.D.
Senior Supervisor

Patricia L. Brantingham, Ph.D.
Member

Neil Boyd, LL.M.
Member

Arvind Verma, Ph.D.
External Examiner
Associate Professor, Department of Criminal Justice
Indiana University, Bloomington

Date Approved: 7 AUGUST 2003

## PARTIAL COPYRIGHT LICENSE



**Title of Thesis/Project/Extended Essay**

Analysis of the Burglary Phenomena: Problem Solving Unspecified Temporal Break and Enters in the City of Burnaby.

Author

(Signature)

Greg Jenion

(Name)

August 12, 2003

(Date)

**ABSTRACT**

Crime is a complex phenomenon and environmental criminology provides a powerful conceptual framework for analyzing the criminal event. Environmental criminologists begin their study of crime by asking when and where crimes occur. Burglary is a serious crime with negative psychological, emotional, and financial costs to the community. Temporal data are collected by criminal justice agencies and provide fairly reliable data sets. Most temporal data collected for burglary are not based on the exact time of event occurrence; instead, the victim gives the investigator an earliest and latest potential time of occurrence. This leaves a time range or window in which the crime could have occurred. Since a large amount of police incident data on burglary is range data, discarding it would ignore the majority of incidents recorded. However, decisions on how to incorporate time ranges can yield very different perceptions of the burglary event. Recent work on this subject has produced a relatively new technique called aoristic analysis, which estimates the probability of a criminal offense occurring within a certain time span. After a discussion of aoristic analysis and other conventional approaches to the range issue, it is argued the technique is a step forward from other previous temporal analysis techniques, but has inherent limitations that prevent it from being a final solution to the time "range," "window" problem.

**Acknowledgements**

I would like to thank Dr. Paul Brantingham and Dr. Patricia Brantingham for inspiring me and introducing me to environmental criminology. I am in the discipline today because of their hard work and commitment to evidence-based research and problem-solving within the community. I would also like to thank Professor Neil Boyd and Dr. Ray Corrado for their teaching which continues to help form many of my ideas and thoughts about crime today. Thanks to the School of Criminology at SFU! Diversity is the friend of those who are willing to learn and be taught.

I also want to acknowledge the cohort group of 11 graduates - each one influenced, molded and challenged my ideas about crime. A special thanks goes out to the crew of ICURS; Bryan Kinney, Aili Malm, Nikki Thompson, Rob Tillyer, Shereen Hassan, and Petra Jones who with encouragement and constructive advice provided motivation at many points along the way. I especially want to thank Martin Andresen who has been my academic partner in the pursuit of knowledge and I look forward to working with him the future.

Finally, I want to acknowledge the love and support of my family. A special acknowledgment goes out to my wife, partner and best friend Sheilah – as well as Leah, Sean, and Joshua all of who listened to far too many discussions on time and crime. Mom – for always being there and giving me the tools for success. Dad – for always telling me to shoot higher and Mi(chelle) – my sister, friend and academic kin – thank you for believing in me. My aunts, uncles, cousins and friends -- for their endless support and encouragement along the way. I not only acknowledge but also dedicate this thesis to you all.

## Table of Contents

**List of Figures**

**List of Formulas**



**List of Tables**



**List of Graphs**

**List of Terms**

*Environmental Criminology* – environmental criminology is the study of the fourth dimension of crime; a discrete location in time and space at which the other three dimensions (law, offender, victim) intersect and a criminal event occurs.

*Burglary* – defined in the International Crime Victim Survey (ICVS) as an incident where someone enters property without permission in order to usually steal something. Most burglaries are committed with the intent to steal some form of goods. However, the Canadian Criminal Code (section 348 (1)) states it is with the intent to commit an indictable offence. This recognizes that not all break and enters are about thieving goods but can involve assaults and mischief as well

*Break and Enter* – See Burglary. This thesis will use the terms burglary and break and enter interchangeably. While there may be need for distinction in the legal realm for ease of reading these terms will be assumed to be speaking to the same criminal event.

*Aoristic Analysis* – an investigation that calculates the probability an event occurred within given temporal parameters, and sums the probabilities for all events that might have occurred to produce a temporal weight in a given area.

*Start Time* – the earliest possible time an event could have begun, often used by the investigator to establish or estimate the initial time of occurrence.

*End Time* – the latest possible time an event could have concluded, often used by the investigator to either establish or estimate the end of the occurrence.

*Exact Time* – a single point in time chosen to represent the actual time an event occurred.

*Range Time* – an event that has both a start time and an end time, resulting in multiple points in time representing the same event.

*Time of Day* – the actual time of day on a 24-hour clock (e.g. burglary took place at 1pm so it would be recorded as 13:00 hrs) to be distinguished from the minute of the day (which would be the 780th minute)

*Time Window* – the period between some recorded start time and some recorded end time where the exact time is not known.

*Time Range* – See Time Window

*Pattern* – is a term used to describe recognizable interconnectedness of objects, processes or ideas.

# Chapter 1: Introduction

*Environmental criminologists begin their study of crime by asking questions about [when] and [where] crimes occur... (Brantingham & Brantingham, 1991:8).*

Crime is well within the human realm of activity. Criminal events are social events (Sacco & Kennedy, 1997) taking place in the world around us everyday. Social events emerge when there is an interaction of participants in time and space. "[C]riminal events are social events in that they involve interaction between human beings" (Sacco & Kennedy, 1997:53); these actors are not alien beings from another planet but individuals like us. Social events, however, are limited to the extent they can be made manifest. There are boundaries in space and time for where and when these things occur and the same is true for criminal events. Criminal events do not 'pop' into being but are the product of a number of interconnected variables. In short, the criminal event is not random or uniformly distributed and because of this it can be analyzed for patterns and trends (Brantingham & Brantingham, 1984; 1991; 1993). The importance in identifying patterns and trends is that they can be used to either predict or derail the event. Ultimately, this may be used to either sound a warning to the community or to prevent the criminal event altogether.

Conventional criminology, however, has more often than not chosen to ignore the importance of these patterns and trends, resulting in criminology failing to meet the needs of the community (Matthews & Young, 1986) and of a more searching scholarly mandate.

## *Problems in Conventional Criminology*

### Failure to recognize the complexity of the criminal event

Criminology has a long history of focusing on the individual offender and ignoring other key components of the criminal event (Young, 1986). It is surprising that some criminologists have not moved beyond such a limited scope of analysis. It seems intuitive that even if we have a fully motivated offender there will be no crime unless the law, the offender, the target and the place merge together in time (Brantingham & Brantingham, 1991). Otherwise, all that is left is a fully motivated offender but no criminal event. That may be a nice circus show – but it is no crime.

Environmental criminology moves beyond focusing solely on the offender and sees crime as a complex phenomenon. This may be unsettling because of demands placed on the researcher; however, the complexity should not dissuade researchers from bringing attention to all the factors which make up a criminal event.

**Failure to recognize and respond to problems in the community**

Criminology has also had trouble in bridging the gap between theory and practice. This stems from failing to see criminology as an applied science and the positioning of criminology as a 'critical' social science. The result has been a propensity to engage in esoteric philosophizing; debating such issues as whether or not there is even such a thing as crime (Young, 1986). Moving beyond such debate requires criminology to be focused on problem-solving within the community. Such a realistic view is highlighted by Don Gottfredson (1989:1) in his article, *Criminological Theories: The Truth as told by Mark Twain,*

> Practicality is not a requisite of a valid theory (a theory might be true yet void of utility), but a good theory may be required for practicality. Kurt Lewin's often quoted remark that "nothing is as practical as a good theory" may be correct, but perhaps it may be said also that nothing is so impractical as a poor one.

It is with this mindset that attention is turned toward the crime of burglary. Burglary is a crime that affects the community with a variety of negative consequences. The extent of harm involved with this crime demands the researcher pay closer attention. Burglary is a serious crime with psychological, emotional and financial implications (Brantingham & Easton, 1996; Tarling & Davidson, 2000; Taylor & Mayhew, 2002).

Problem-solving theories and solutions need to be developed which can be acted upon by criminal justice personnel and the local community to deal with this issue. Criminological theory needs to be problem-driven and solution-focused so as not to be divorced from the real world. In

contrast, philosophizing more often than not leads only to the minimization or romanticization of the crime and the criminal, serving those who prey upon others for their own gain.

Disconnects between most theory and practice can be resolved if a focus towards problem-solving is maintained. Before looking at the burglary phenomena, a brief discussion regarding the importance of viewing criminology in a traditional scientific manner will be advanced as the starting point for any future analysis.[1] Ultimately this results in an orientating strategy that gravitates the researcher towards theories that are focused on problem-solving which can be tested and refined, ultimately bridging the gap between the academic and the practitioner.

## *Objectivity of the Scientific Method*

*"Criminologists should pay attention to some fundamental tenets of scientific theory building" (Gottfredson, 1989:1).*

It is important for all researchers to lay out their orientating strategy when approaching research and theorizing. An orientating strategy is a conceptual framework or worldview that allows others both to interpret the researcher correctly and to understand any individual biases the researcher brings to the analysis. It is the worldview in which

---

[1] This does not purport to be an exhaustive overview as this topic. Books and articles that have influenced my view of research can be examined in more detail in Matthews and Young (1986) and Francis Fukuyama (1999).

all things fit together – or the umbrella that all things stand under. It is assumed that all research contains individual bias. The important issue is not whether there is bias or even the amount of bias, the issue is, does the bias result in error? One of the strengths of the traditional scientific approach is the recognition that bias is an inherent part of research (Gottfredson, 1989). However, the scientific method tells us that individual bias is not what should be focused on; instead the tools of measurement and the ability to verify and replicate the results of the research are of greater importance. Again, the objectivity of science is that it recognizes that there is bias and develops methods[2] to deal with that bias. Objectivity is not based on the motivations of the researcher or what experiences may shape the researcher's perspective but instead on what can be produced and replicated by others who may or may not have the same bias. As part of the principles of science it is necessary all factors in the approach of an individual perspective be available for criticism and the perspective be articulated in a clear and concise way so as not to leave the critic guessing as to what the theoretician was meaning. Again, bias is not the issue – the issue is error. It is the clarity and certainty of the findings. If an individual accepts the scientific method as a fairly robust technique for discovery, the next step is to

---

[2] This favors an abductive approach to the scientific method rather than a deductive or inductive one (the process need not be limited to a traditional static linearity as this does not reflect what happens in the real world). For a more detailed examination of the topic see John R. Josephson, Abductive Inference: Computation, Philosophy and Knowledge. Cambridge University Press, 1996.

orientate oneself into a set of domain assumptions that help conceptualize the issue.

In looking at the problem of burglary within communities it then becomes important to find the orientating strategy that recognizes the need for purposeful communication and problem-solving and move towards a theory that gives insight into the phenomenon. Environmental criminology is the criminological orientating strategy that allows all the dimensions of crime to be brought together for understanding a criminal phenomenon - the goal of which is to help solve problems in the community.

Some key domain assumptions of environmental criminology are:

- there will always be law
- there will always be lawbreakers
- there will always be crime
- there will always be individuals who are motivated to commit crime
- there are boundaries in time and space within which individual activity occurs
- and crime therefore, will not be random or uniformly distributed

These assumptions are brought to the study of all criminal phenomena and are foundational to the advancement of knowledge in criminology.

This thesis will focus on the crime of burglary. It will give attention to temporal components of the phenomenon, which have often been ignored in criminal event analysis. Specifically, this thesis will explore issues related to time "windows" or "ranges" of the burglary event. The time windows are recorded by potential start and end times but no actual

time of occurrence. A start time is the earliest recorded potential time of occurrence for the burglary event. The end time is the latest potential time of occurrence for the burglary event. These times are most often given by a victim (or witness) to an investigator who records them in an incident report. Exploration of conventional knowledge regarding time and burglary will help review what is currently known. Analysis reveals there are many conflicting accounts of this relationship. At present, the time/burglary relationship is neither well documented nor as clear as commonly assumed among criminal justice personnel or academics. Problems and limitations in the way information is gathered will show we may not know what we think we know. In most cases, the majority of data we do have on burglary provides only ranges of time within which the event occurred. In trying not to disregard a large amount of recorded information this thesis will explore the problem of calculating the relationship between time and burglary using both exact time and time range data from police incident reports in the City of Burnaby, British Columbia. Discussion and recommendations to both the academic and criminal justice community will be advanced to try and clarify this criminal justice and community problem.

## Chapter 2: Burglary and Environmental Criminology

> *A crime is a complex event. A crime occurs when four things are in concurrence: a law, an offender, a target, and a place. Without a law there is no crime. Without an offender, someone who breaks the law, there is no crime. Without some object, target, or victim, there is no crime. Without a place in time and space where the other three come together, there is no crime (Brantingham & Brantingham, 1981:7).*

### *Environmental Criminology*

The criminal phenomenon of burglary is best understood in the theoretical context of rational choice/opportunity theory, under the umbrella of environmental criminology. This context shows a burglary to be committed when four things are in concurrence: a law, an offender, a target, and a place (Brantingham & Brantingham, 1991). The fruition of this phenomenon comes when these things merge together in time and space. "Environmental criminologists begin their study of crime by asking about where and when crimes occur" (Brantingham & Brantingham, 1991: 8). It is through this lens the phenomena of burglary can best be advanced. The majority of explanations, for burglary, fall under the umbrella of environmental criminology and lie in rational choice and opportunity theory (Cornish & Clark, 1986; Felson, 1994; Wright & Decker, 1994).

## *Conceptualization of the Phenomena Using Rational Choice Opportunity Theory*

Many have undertaken to further our knowledge of the criminal phenomena of burglary (for example, Cromwell, Olsen & Avary, 1991; Maguire & Bennett, 1982; Scarr, 1973; Wright & Decker, 1994). Most of these studies have led toward understanding burglary as a rational opportunistic crime (Cornish & Clark, 1986; Felson, 1994; Wright & Decker, 1994;). Rational choice and routine activities theories both hold themes that overlap one another and fit well into environmental criminology (Brantingham & Brantingham, 1993). Drs. Paul and Patricia Brantingham (1993) have outlined some of the various points each of these theories have in common, among them are:

- Criminal events are best viewed as the end points in a decision process or sequence of decision-making steps.
- The decision process leading to the commission of any particular crime begins with someone who is in a state of readiness.
- Criminal motivation levels or states of readiness to commit crime come from diverse but quite understandable sources.
- Target suitability is tied to both to the characteristics of the target and to the characteristics of the target's surroundings.
- Individuals develop "images" of what surrounds them; these images are called templates.
- Templates vary by specific crimes, offenders and the general context for the crime.

These commonalities allow environmental criminology, rational choice theory, and routine activities theory to be discussed together. Emphasis is placed on different components of the criminal event by each model but

all can be intertwined to advance understanding. All look past the offender. All allow an inclusive approach, incorporating many variables in its analysis. Conceptualizing crime in this way moves away from a bogged down motivational analysis of the individual and forwards the idea that the criminal event can be something prevented without focusing solely on the offender or fully understanding him either.

Rational choice and opportunity theorists focus on how offenders make their decisions. Offenders' decisions appear to be driven by a variety of different motives. Those motives are most often found to be financial (Cromwell, Olson, & Avary, 1991; Regert & Wasilchick, 1985; Wright & Decker, 1994). The reasons for economically-driven crime are often tied to unemployment or debt. Others reasons range from opulent lifestyles to drug addiction and gambling. Some motives are tied to risk taking (Cromwell, Olson, & Avery, 1991). This is seen most often in younger burglars who appear driven by a need for excitement or excessive stimulation. Other less common motives are found in psychological fetishes and obsessive compulsions. All of these may give insight into the offender's mind and suggest different decision mechanisms could be in place for different offenders. However, without an analysis of where and when these things occur there appears to be few practical or successful preventative strategies that can be developed; a purely motivational account is insufficient.

*Garden Variety Burglars and Burglary*

A popularly held stereotype of a burglar is the famous cat burglar. Images come to mind of a darkly dressed individual prowling around, secretly infiltrating a residence, stealing some form of riches from a safe tucked away behind a picture or hidden within a wall. This is probably due to television and Hollywood movies portraying such images across most parts of the country[3]. However, the average burglary is quite different from the image projected and distributed by the entertainment industry.

The average burglar in Canada is committed by a youthful male who walks up and down the streets seeing if anyone is occupying a residence by knocking on the front door (Goff, 2001; Waller & Okihiro, 1978). If no one is home the burglar proceeds to kick in a door or smash or jimmy a window in an attempt to gain entry inside (Cromwell & Avery, 1991; Gottfredson & Hirschi, 1990). Once inside, the burglar searches for items that can easily be transported such as electronics equipment, jewelry, liquor, or money (Mawby, 2001). These items are ones that either appeal to the individual for personal keeping or things that can most often be pawned at a local store, bar, or gathering place of peers.

---

[3] Some famous cat burglary scenes in Hollywood productions are; Cary Grant in, "To Catch a Thief"; Sean Connery & Catherine Zeta-Jones in the movie "Entrapment".

The average burglar is a Caucasian male, under the age of 25 (Bartol, 1995; Mawby, 2001; Goff, 2001), who has a prior criminal record for property offences and theft. He is usually half-heartedly committed to burglary and is considered an amateur.[4,5]

Spatially, burglars are known to burgle in many areas. There are areas, however, that are more at risk. The British Crime Survey found that the highest rates of burglary occurred in multi-ethnic, low-income areas (Mawby, 2001). Tarling and Davison (2000) report that the poor, the disadvantaged, and inner city dwellers are most likely to experience burglary. Design features (Newman, 1973), proximity to major roads and arteries (Rengert & Wasilchick, 1985), well traveled pathways (Brantingham & Brantingham, 1993; White, 1990), and even foliage (Jackson & Winchester, 1982) play a role in where these criminal events will occur – ultimately because they tie in well with the offenders decision making process.[6]

---

[4] It is important to recognize that there are many different typologies of burglars which serve as useful ways to distinguish different types of criminal events. Although not the subject of this study, some of those distinctions that can be useful are: amateur vs. professional, young vs. old, alone vs. group, need vs. compulsion, opportunistic vs. planned, etc. This is not an exhaustive list, only an illustration of the types of distinctions that can be made.

[5] As well as different typologies of burglars there are different typologies of burglaries. The most common distinction made in the literature is between commercial and residential burglaries. Less common distinctions are between smash and grab types of events, garages, and public schools and distinctions between mobile homes or hotel rooms.

[6] The importance here is only to bring attention that there exists much research on the spatial patterning of burglary; however this thesis will focus on the less examined temporal nature of the crime.

Understanding of the criminal event is predicated on the convergence of variables in time and space. Space is not the only element of crucial importance. Precision of temporal occurrence is crucial to further knowledge of the criminal phenomenon as well. Decisions based on time can yield very different perceptions of the event. The crucial component of merging both time and space analysis can lead to both proactive and reactive prevention strategies in an effort to decrease their occurrence. When this has occurred, the result has been success in attempts to thwart the crime (Clarke, 1997; Felson, 1994). Spatial analysis has undergone the most thorough and rigorous examination (Brantingham & Brantingham, 1991). In comparison, there has been little work done, in comparison, with the analysis of time. An analysis of time is needed to confirm that, "crimes do not occur randomly or uniformly in time or space activity" (Brantingham & Brantingham, 1993:5).

Before turning our attention towards time (which seems to be a neglected area of research in environmental criminology), a closer look at the crime of burglary will be taken to see if the communities' perception of burglary and its negative consequences indeed pose a problem worth examining.

## *Burglary*

### Burglary: A Serious Crime

Canada considers the crime of burglary a serious offence, as reflected in the Criminal Code. Canada's Criminal Code states an individual who is convicted of break and entry[7] of a dwelling house is, "liable to imprisonment for life" (C.C.C., 348 (1) (d)). Other nations have also recognized burglary as a serious offense. In Australia, housebreaking without any aggravating circumstances may be punished by imprisonment with hard labour for 14 years. If the crime of burglary is done between 9 pm to 6 am the individual may be, "liable to imprisonment for life with hard labor" (Harper, 1985). Historically, burglary has been looked upon as a terrible crime, as Sir W. Blackstone stated in 1809,

> Burglary has always been looked upon as a very heinous offence, not only because of the abundant terror that it naturally carries with it, but also as it is a forcible invasion and disturbance of that right of habitation which every individual might acquire even in a state of nature...the malignity of the offence does not so properly arise from its being done in the dark as the dead of night, when all creation, except beasts of prey, are at rest; when sleep has disarmed the owner and rendered the castle defenseless (Walsh, 1980).

---

[7] This thesis uses the terms burglary and break and enter interchangeably for ease of reading and understanding. It should be noted that technically legal differences exist and each term may be defined differently by different legal systems.

The United States, Britain and a majority of European nations have similar sentences for burglary. Obviously these sentences reflect not just international community concern but also national and international condemnation when it comes to the crime of burglary.[8] This condemnation stems from not only the perceived intrusional nature of the exploit, but the harm caused by the crime itself.

The Bureau of Justice Statistics and the Federal Bureau of Investigation (FBI) state there is a crime of burglary committed every three minutes in the United States and Canada. What is being conveyed most often is the extent of the crime of burglary. The danger, however, is for the reader to think that there really is a crime of burglary every three or four minutes – this simply is not the case. There is no sound reason to believe burglary is occurring in such a uniform pattern (Brantingham & Brantingham, 1993). However, recognizing the frequency of burglaries can help heighten awareness and dispel any suggestions that this is an isolated and sparse act. Once the extent of the act is known, criminal justice personnel, along with the community, can determine the harm involved and the best plan of action to take.

---

[8] "Our criminal justice system developed from a natural desire to provide protection to both the individual safety of a person and to his or her property. Just as the law has created a range of offences in relation to the protection of a person's physical safety, ranging from common assault to murder, so a range of offences has been created to protect individuals from damage to their property or deprivation of it. Within that framework of the law which protects the rights of individuals to security of their person, there have evolved laws specifically directed towards the protection of their most important possession: Their home" (Harper, 1985:3).

**Canadian Breakdown**

Canada has followed other North American and European countries in the 20th century with dramatic increases in the level of property crime from 1960 into the 1990s and remaining well above 1960 levels to the present day (Fukuyama, 1999). Break and entering in Canada is the second most occurring property crime (Goff, 2001), behind common theft. Colin Goff (2001:133) states that, "[break and entering] accounts for 25% of all property incidents and 15% of all reported Criminal Code offenses." Further, "Sixty-three percent of all break and enters occurred in residences during 1998 followed by businesses (26 percent) and "other" premises (11 percent)". The prevalence of burglary in Canada can be seen as a major issue within the criminal justice system. This prevalence has costs associated with it which are significant.

**Costs of Crime and Burglary**

Crucial to a discussion of the prevalence of crime is a discussion on the costs of crime. The reason is to respond to a real and harmful problem that exists, and also to convince people who are minimizing the events and magnitude of harmful effects on the community to change their minds and respond to the problem. As previously discussed (see Chapter 1), criminology has had a tendency to focus solely on the offender. One outcome of this focus is that little or no attention is given to the costs borne by the victim or society. The cost of burglary should not be measured in monetary terms alone, other reverberations of

psychological and emotional damage need attention as they last long after the criminal event is over. These negative effects occur both at the individual and the societal level.

Burglary is not a victimless crime. Individuals who have had the misfortune of experiencing a burglary are often left with deep psychological and emotional scars. A study by the Australian Institute of Criminology found that psychological costs of commercial burglary were substantial, reporting that one in four experienced increased fear of crime (Taylor & Mayhew, 2002). Some had nightmares and sleeping difficulties and a few (9%) could not attend the premises again. The damage to individuals who have had their residential homes invaded is even more serious. Often individuals sell their homes and move. The less fortunate stay and have lingering fear every time they leave the premise.

The financial impact of burglary in the Canadian context has not been well documented. Brantingham and Easton are among a few researchers who have explored the issue. In their booklet, *The Cost of Crime – Who Pays and How Much?,* they report the average loss to the individual for the crime of break and enter in Canada to be $2300. In B.C. for 2001 there were 51,923 break and enters known to police. In assuming the average loss is $2300 – the cost to victims would be

approximately 120 million dollars to the province alone.[9] Total property crime[10] loss on crimes known to the police was estimated at 4.6 billion dollars. Estimates based on victimization surveys put the cost at an extraordinary 11.5 billion dollars per year. Goff (2001) also states the financial cost to Canadians is massive. Insurance claims alone in 1998 for commercial and residential burglaries totaled almost 400 million dollars (Tremblay, 1999). In times of fiscal restraint and program cutbacks excessive financial expenditures for the crime of burglary are unacceptable to any reasonable individual.

Crime impacts not only individual victims but society as a whole. The individual victim of the crime is usually the one focused on when calculating the impact of crime. However, some have recognized the impact of crime beyond just the individual victim. Taylor and Mayhew (2002) displayed the cost beyond a single offender or victim in their study on the impact of commercial burglary in Australia,

- for government, through lost revenue;
- for customers, through higher prices;
- for taxpayers, through having to fund a more expensive criminal justice system;
- for employees, through increased fear and possible job losses; and

---

[9] Assuming that only 2/3 of all break and enters are reported to police. The more realistic cost estimate is probably around 180 to 200 million dollars.

[10] This includes theft, mischief, break and entering and motor vehicle theft (Brantingham & Easton, 1998).

- for all businesses, through higher insurance premiums and the potential effects that business closures due to crime could have on other businesses (Taylor & Mayhew, 2002:1)

A burglar who is found to have committed a break and enter with a theft of $2050 can end up costing the taxpayer approximately $137,000. Another effect on society can be an increased fear of crime. It has been well documented by Wesley Skogan (1990) that increased fear of crime leads to a lack of sense of community and isolation from people's neighbours. The outcome is towards decline and disorder of a community and increases in every area of criminal activity. When a general perception and fear of crime increases it results in a perpetual cycle of decline and disorder in society (Skogan, 1994). The result is devastated communities and a wake of victims left behind.

The monetary costs for burglary are large enough that this effect alone demands a response from government, community, and individuals. Coupled with the psychological and emotional damage, inaction is negligent, a cruel response to victims within the community, and a disregard for ordered societal relations.

The recognition that the crime of burglary is a harmful problem to the community compels those who study the phenomenon to seek a greater understanding of the event. This understanding is ultimately focused on decreasing the prevalence and incidence of the crime. The temporal components of burglary will be looked at because they are a key component of environmental criminological understanding. These

components have not been studied as much and need to be more thoroughly examined. Chapter Three will turn our attention towards the importance of time in understanding crime.

# Chapter 3: Burglary and Time

> *Human lives unfold in time. All human activity has a temporal dimension, and all of it takes place in a temporal as well as a spatial context. Time, therefore, would seem to be a fundamental dimension of every field of the social and behavioral sciences, as it has been for most of the physical and biological sciences. But, in fact, time has been given remarkably little attention in the social psychology [criminology], far less attention than its key role in human lives warrant[s] (McGrath, 1988:7).*

## *Why Focus on the Temporal Nature of Crime?*

Why is it important to look at time when analyzing crime? Understanding time and its relation to space, cycles, patterns, typologies, hot/cold spots, victimization, and various heightened level of risk periods, all provide important theoretical advancements and practical policy incentives.

> Time is an important component in the understanding of criminal occurrence. While it is known that crime follows opportunity, it does not necessarily follow that opportunities remain constant over time (Ratcliffe, 2002:25).

An analysis of time can yield important trends in cycles and patterns of crime that facilitate law enforcement and help communities with crime prevention efforts. Time can also increase our understanding of what type of offender and victim are involved in a crime. Time's relation to

space may reveal dynamic changes in the environment allowing future prediction of criminal events and activities. Over time we can see areas that are more prone to criminal activity or have ceased from activity altogether. Various levels of analysis or "cones of resolution" can provide insights into year, season, month, week, day, hour and even minute patterns around a criminal event, providing a starting point in trying to prevent the event from occurring again.

## *What is Time?*

A "hard science" definition of time is given by Lauer (1981) who defines clock time as,

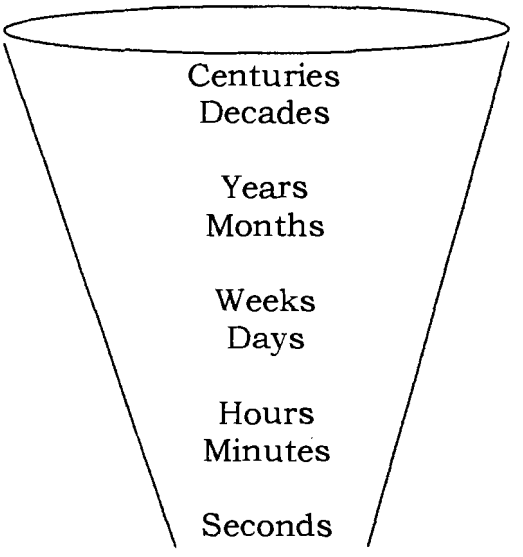
> Clock time is an objective external nonsocial referent for the unfolding of behaviour. In its extreme use, it defines time as a succession of seconds, where a second is measured by 1,192,631,700 cycles of the frequency associated with the transition between two energy levels of the isotope cesium 133 (McGrath, 1981:21).

What is important is the "objective external nonsocial referent" nature of time. Time is a boundary in which the unfolding of all human behaviour occurs and is defined. Time is a component that shapes human social relations and criminal events. Biological necessity (sleep) and social responsibilities (work) establish routines that are clearly identified and trackable in what we call time. How these activities mingle with space and contribute to human behaviour may differ according to individual cultures but all societies will have regular patterns of activities behaviour in time.

*The Temporal Cone of Resolution*

There are various levels and points at which time and crime can be analyzed. Not all levels of analysis will be equally beneficial to the researcher. It is then important to decide what level of analysis is best suited for study. Some of the most common levels of analysis used in the field of criminology when looking at time and crime are: centuries, decades, years, months, weeks, days, hours, minutes and even seconds of the day.[11] Graph 3-1 illustrates some of the various cones of resolution.

**Graph 3-1: Various Cones of Resolution**




Dr. Patricia Brantingham has noted that, "although time is continuous, the analysis of temporal patterns requires the fixing of a time period. The time interval that is selected sets the level of resolution for analysis and

limits the questions that can be asked" (1984). Picking an appropriate level of resolution becomes important as too broad an analysis leads to a lack of clarity and too narrow an analysis leads to a misinterpretation of what is really going on.

### *Problems in Time Data*

In the analysis of time it is generally accepted that the more precise a person wants to be the more inaccurate the available information will be (Maguire & Bennett, 1982). Until recently, time has been an unrealistic variable to capture when trying to gain insight into changes at more precise levels (particularly hours/minutes). This is due to the fact that primary sources of statistical evidence for time could, until recently, only be found in four areas: self-report surveys, victimization surveys, official governmental statistics and police databases. Each of these sources has severe limitations in scope and precision in its time measurements. In general, criminal justice databases are more robust in their reliability[12]

---

[11] The more uncommon units of time measurement would include millennia, milliseconds, and nanoseconds.

[12] "Reliability in criminology has been referred to as the degree to which repeated observation of a phenomenon – the same phenomenon at different times, or the same instance of the phenomenon by two different observers – yields similar results. Most social scientists demand the same standard for scientific findings before the gain the stauts of fact – unless you can show other people can make the same measurements you do, and unless others can replicate your findings, your observations and findings are not considered worthwhile" (Palys, 1997:425,425).

than other databases as they are mandated to be collected regularly and are compiled in a detailed and professional manner.

**Self-Report Surveys**

Self-report surveys are one way of trying to gauge an understanding of criminal activity. In relation to time and burglary, property offenders are more willing to talk to interviewers regarding their offence if guaranteed confidentiality and anonymity (Rengart & Wasilchick, 1985). Few studies have been able to grant such immunity, making self-report studies of offender testimony less appealing then other types of gathering methods.[13] Even when guarantees can be given there are problems, such as the quality of information. Self-report surveys are known to be plagued with perception errors (i.e., telescoping) of the individuals who give them. However, this is one way of getting at information about time and burglary.

**Victimization Surveys**

Victimization surveys are also used to gather information about time and crime. Victimization surveys, however, mirror similar problems as self-report measures in the quality of data they produce. Like self-report measures they rely on individuals to report their experiences

---

[13] As universities continue on their course to be protected from liability concerns it will be more and more difficult to meet the ethical demands in gathering research this way within incarcerated population – especially young people.

accurately (Statistics Canada, 2001). Often victims do not discover they have been burglarized until many hours or even days and weeks after the offence. They cannot give precise time information because they have no idea when the burglary occurred or even what was taken. However, they do yield important information about who is being victimized and the prevalence of the criminal events that are not captured by law enforcement agencies.

**Official Government Statistics and Police Data**

Official government agency and police data often provide a more reliable basis for gathering certain variables in many crimes. Police data reflect one of the most consistent forms of annual data gathering. Police officers are mandated to fill out forms and collect and store information upon discovery of a criminal offence or the arrest of an individual. The advent of 911 emergency calling lines has resulted in more precise time measurements for individual crime (as computers store information on when the crime is reported, often as it happens). In some cases exact times are known. However the majority of time information on crimes has remained elusive (due to the fact that most people discover that a crime has occurred instead of coming upon it as it happens). In the case of burglary, a time window may exist between the actual event, the time it was discovered, and the time it was phoned in by a complainant. These time ranges gathered by police for such crimes encompass the majority of

recorded incidents in police databases. The criminological research that has been done on time and burglary has usually incorporated only the exact time. This is because range times are hard to deal with. The problem is that there is a wealth of data that is gathered in which information could be gleaned but because it is in range form it is hard to know what to do with it.

## *Literature Review of Distinctions when Analyzing Burglary*

### Residential Versus Commercial

It is reported fairly consistently that two-thirds of all burglaries involve break and entering into a residential premise (Bartol, 1995; Mayhew, 2001; Rengert & Wasilchik, 1985; Reppetto, 1974; Statistics Canada, 2001). The remaining third are commercial businesses. Dermont Walsh, in his book, Break-Ins: Burglary From Private Houses, shows a typical breakdown of places burglarized within a district for a year. Houses (along with flats) and garages make up most of the burglarized sites, followed by shops, warehouses and schools (Walsh, 1980). Others have confirmed this finding as well (Chimbos, 1975; Figlio, Hakim, & Rengert, 1986; Rengert & Wasilchik, 1985; Repetto, 1974; Scarr, 1973). Although discrepancies abound when it comes to the percentage distribution of residential and commercial burglaries, agreement appears to be reached pointing to a greater amount of residential versus commercial break-ins. Residential and commercial break-ins should also be analyzed in separate

categories as the literature and theory suggests they will differ significantly in their time of occurrence; this will be explored in Chapter Four.

## *Various Cones of Resolution*

### Seasons/ Months

There is conflicting evidence regarding which seasons and months of the year have a greater number of burglaries. Maguire and Bennett (1982) suggested that the midwinter months, notably December, produced more burglaries than the summer months. Other texts, such as Bartol's Criminal Behavior: A Psychosocial Approach, state "burglaries are more likely to occur during the warmer months especially August" (Bartol, 1995:323).

Conflicting reports of seasonal incidence of burglary were recognized earlier and led people back to observations made in the early 1970s that there is little, if any, seasonal variation in the incidence of reported burglaries (Pope, 1977). In Patterns of Burglary, Scarr found that there are, "no seasonal fluctuations in the incidence of burglary" (1973:141). At the evidentiary level then, there seems to be a lack of consensus from the research.

Theoretical explanations seem more powerful than research evidence for seasonal fluctuation in burglary patterns. Rational choice/opportunity theory suggests a pattern of increased burglaries in

summer months as opportunities increase for victimization. Summer months, it is argued, give burglars ample time to take advantage of people on vacation and away from their homes. The summer temperatures often result in people leaving their windows or doors unlocked and opened (Bartol, 1995). This is not to suggest that temperature alone is responsible for the changes in burglary occurrence. There are several temporal activity generators that may also have an effect; holidays like Christmas and Spring Break, moving days that are tied to the school year, and more general month end moving; all of which provide burglars with predictable temporal opportunities for criminal victimization.

**Days of the Week**

When analyzing time and the days of the week it is important to distinguish between residential burglaries and commercial burglaries. It has been suggested that residential burglaries often take place during the week while commercial burglaries appear to take place on the weekend. This is sound theoretically when applying rational choice/opportunity theory to this temporal situation. Most people are away from their homes during the week because of work, school, or appointments. Commercial establishments, unoccupied most often on weekends, are vulnerable to burglary at that time.

In making this initial distinction it becomes necessary to look at the days in which each type of burglary occurs. If any particular days should

be noted, it seems Thursday, Friday and Monday rank the highest (Walsh, 1980). However, most literature fails to see any dramatic difference in the days of the week (which could be in the initial failure to distinguish between residential and commercial burglaries). The exception may be possible paycheque times that seemingly coincide with higher incidents of burglary.

**Hours of the Day**

The hours of the day have been the most-studied temporal component of burglary. Even though this cone of resolution has been given much attention, inconsistencies are still found throughout the literature. The first studies to look at time came in the form of self-report interviews with burglars (for example, Rengert & Wasilchick, 1985; Walsh, 1980). The burglars indicated that for residential establishments the best time to burgle was from 9 am to 11 am and from 1 pm to 3 pm. Businesses were much harder to gauge with the time usually being somewhere from 7 pm to 5 am on weekends.

It makes intuitive sense that during these times most suburban residences are unoccupied. Sometimes homes are left unoccupied because of both individuals working, other times the resident is out running routine errands.

Businesses were much harder to gauge with the time usually being somewhere from 7 pm to 5 am on weekends. It seemed that the hour

could partly be determined as a function of the structure being broken into.

**Minutes of the Hour/Seconds**

Researchers perhaps know the least about the finer cones of resolution when analyzing burglary. First, time at this cone of resolution has been nearly impossible to gather. There is simply not the technology to give such measurements. The only time information at this level is reports on how long it takes the police to respond to a call and some self-report data on how much time was spent inside the home by the burglar.

Secondly, understanding time measurements at this level requires complex conceptual models. These models would try to incorporate a number of biological, sociological, and environmental factors. The integration of these levels is not an easy task. The rewards of such research could be great precision at this level and may help merge an understanding of motivation and decision-making processes that go into committing offences like burglary.

**Summary**

Time is an important component of human behaviour. All human behaviour is shaped and bounded by time. To get at the various cones of temporal resolution, self-report and victimization surveys are used to gather information. Criminal justice databases, particularly police

databases, are more robust databases for information. Most data collected on burglary by the police are range data. This data has a potential start and end time but no exact time of occurrence for the event. These range events make up a majority of collected incidents when it comes to the crime of burglary. Inconsistencies and holes in the literature point to the need for clarification at the various time resolution levels. Although some discrepancies may be reached by sorting out types of burglaries, range data may yield insight into these issues and help resolve differences. It is therefore crucial to incorporate the data we do collect to provide clarity and understanding into the phenomena of burglary.

# Chapter 4: Methodology and Results

## *A Research Partnership*

In order to research the time range issue it was necessary to first access burglary data held by a local law enforcement agency. Gaining access to criminal justice data can be time consuming and problematic. Often partnerships need to be formed in order to establish legitimacy and fend off security concerns.[14] In order to obtain data for this research project a partnership between the Burnaby Royal Canadian Mounted Police (RCMP), the Crime Prevention Analysis Lab (CPAL Inc.), the Institute of Canadian Urban Research Studies (ICURS) and Simon Fraser University (SFU) was formed. Working within this partnership allowed various group interests to be considered when looking at the phenomena

[14] It should be noted that law enforcement agencies often use security clearance as a reason to prevent researchers from having access to databases. In some cases this is a legitimate concern as there are individuals who would use the information to harm others. However, most motivations for police officers in preventing access seem to stem from protecting various stakeholder interests. Often for the sake of a good thesis or dissertation researchers trample upon these interests, which causes the guardedness by police. It is imperative that sensitivity towards political agendas be weighed before damaging conclusions are forwarded (stakeholders need to be given the chance to respond to criticism and not ambushed by it). Generating a stimulating read may not be good for the discipline of criminology in the long run.

of burglary and its relationship to time and access to be obtained to otherwise non-public information.[15]

### *Burnaby Royal Canadian Mounted Police Database*

Access was initially granted to the data after an interview with the RCMP and a draft contract between CPAL Inc. and the researcher. The interview with Staff Sergeant Deans established the legitimacy of the research that was going to be conducted. The contract with CPAL Inc. and ICURS dealt with security concerns about both the physical storage of and control over how the information could be distributed. Simon Fraser University then guaranteed the study would be done within the guidelines developed by the University's ethics committee. Although the process was onerous at points, dragging on for long periods of time, the result was an increased awareness and consideration of all the various perspectives of the interest groups involved.

---

[15] It is interesting that so much police data are non-public information. It is taxpayers who pay for policing. It is taxpayers who share the burden for the harmful impacts of criminal events. Yet the taxpayer is not able to see the information that is collected on harmful crimes against his/her own community. Why is the average citizen not able to access the information in a more reasonable and timely manner? Politicians need to develop more thorough examinations of government data to know what is going on and what policy changes have good effects and what ones do not. This has to be determined by an outside agency, not a branch of the state.

Note: Some data may be embarrassing to 1. a) victims, b) suspects later exonerated 2. Some data may form a key component of ongoing investigation, intelligence, prevention and planning. In either case there may need to be adequate safeguards to protect these various legitimate concerns

The information provided by the RCMP was not public information. As stated above, permission had to be given by the RCMP to explore and analyze the data. This permission was attained through Staff Sergeant Deans of the Burnaby RCMP after a face-to-face interview. The information which CPAL Inc. was holding was then turned over to the researcher on a CD-ROM which was kept within a secure lab (ICURS) at Simon Fraser University. Security of information was maintained at all times. ICURS has extensive security equipped with surveillance cameras and user access restrictions (magnetic code card access), which allows sensitive data to be stored and analyzed.

### *The Crime Funnel and Dark Figure*

It is important to recognize the level of data being dealt with in the RCMP Burnaby city dataset. The data captured by police agencies do not reflect the actual amount of burglary that exists. As Goff states in his text book, *Criminal Justice in Canada*, "when a crime is [reported] it enters the big end of the funnel; the case passes through the funnel and exits the small end when an offender is either acquitted of all charges or is found guilty and sentenced" (Goff, 2001:25). Figure 4-1 represents the issue in a Canadian context of cases flowing through the criminal justice system.

**Figure 4-1: Caseload within the Canadian Criminal Justice System, 1996**

Actual Number of Crimes "Dark Figure"

Total Incidents Reported to the Police = 2,832,800

| | |
|---|---|
| Offences Reported to Police | ----------100% |
| Offences Reported as Actual | ---------- 96% |
| Offences Cleared | ---------- 34% |
| Offences Cleared by Charge | ---------- 22% |
| Convictions | ------- 15% |
| Sentenced to Custody | ---- 4% |

*Source: Statistics Canada, Juristat, Catalogue 85-002, 1997, Vol.17, No. 1, p.1.*

Of course, outside the funnel are all crimes. This is often referred to as the elusive "dark figure" of crime, which is all the crime that exists but may not enter the Canadian criminal justice system. Police incident reports are toward the top end of the crime funnel and are not meant to be an exhaustive representation of all burglaries that occur. The burglaries are also particular to the city of Burnaby and as such it is useful to take a moment to comment on some of the characteristic features of this city.

**Profile of the City of Burnaby**

The RCMP collected data in the city of Burnaby located immediately east of the city of Vancouver in British Columbia. The size of the city is 98.60 square kilometers (38.07 square miles) and is located centrally within the Greater Vancouver Regional District (City of Burnaby, 2003).

The city is bordered by Vancouver, Coquitlam, New Westminster and Port Moody on its west and east sides. Two waterways (Fraser River, Burrard Inlet) border the north and south boundaries of Burnaby. The city's homepage[16] states,

> Burnaby is a maturing, increasingly integrated community, which is centrally located within a rapidly growing metropolitan area. Burnaby's characteristic has shifted from rural to suburban to largely urban. The City features high density residential areas, major commercial town centers, rapid transit, high technological research and business parks, comprehensive industrial estates and major post-secondary institutions (City of Burnaby, 2003).

The city of Burnaby contracts the Royal Canadian Mounted Police (RCMP), as many municipalities in Canada do, to provide policing. Burnaby's population increased 8.2% from 1996 to 2001. This resulted in population growth from 179,209 to 193,954 (City of Burnaby, 2003). This city is in some ways urban sprawl from the city of Vancouver and is greatly affected by trends that transcend its borders.

**Data Analysis**

In order to analyze the Burnaby RCMP data some data cleaning had to be performed. In its original state, the data could not be analyzed with current statistical software programs. To facilitate data analysis, date and time formatting and street addresses had to be standardized. In total

---

[16] www.burnaby.bc.ca

the Burnaby RCMP database held information on 10,226 burglaries over the years 1995, 1996, 1997, 1998, 1999, 2000 and 2001. The *commercial* break and enter database held 3295 records and 65 tables. The *residential* break and enter database held 6931 records and 65 tables. This data was imported from Access into Excel[17] and then from Excel into the Statistical Program for the Social Sciences (SPSS) for further computation and analysis. Data were also imported into MapInfo and ArcView for visual examination. New software for MapInfo developed by Jerry Ratcliffe (Ratcliffe, 2000, 2002; Ratcliffe & McCullugh, 1998)[18] using the latest aoristic analysis techniques was used to explore the data range window issue.

**Foreshadowing Analysis to be Done**

Exploratory analysis was first conducted on the Burnaby RCMP database containing police incident reports of commercial and residential break and enter crimes for Burnaby between June 1995 and April 2001. The research focused on the temporal components, looking for patterns

---

[17] It should be noted that the transformation of data from Microsoft Access to Excel was not easy. A security cleared software expert (staff member at SFU) was called upon to merge various tables together within Access and transform them into Excel. Initial difficulties include transferring the various time formats into ones that Excel would find easy to recognize and manipulate.

[18] Jerry Ratcliffe provided a copy of his Hot Spot Detective Program for Map Info for the examination of the RCMP Burnaby burglary data. I wish to express a special thanks to Jerry Ratcliffe both for his generosity and pioneering work in this field. Although I have not met Jerry Ratcliffe I wish to someday share in his knowledge of this complex criminal event.

and trends in crimes for which exact time data was available and in crimes for which only range time data was available. A variety of statistical techniques were used to provide insight into the relationship between time and burglary. The Burnaby RCMP maintained the data set in a Microsoft Access Database. Tables were connected and linked in Microsoft Access before moving the data into Microsoft Excel for cleaning.[19]

As mentioned, the original data set contained over 10,000 cases across an almost six-year time span. Exploring this data set yielded a distinct recording difference in the years 1995-2001. Therefore two decisions were made. The first was that for the initial independent samples t-test (to distinguish categories) between commercial and residential burglary the entire data set would be used. The second decision was that if this separation was going to occur future analysis would only be done on the years 1998 through 2000 because they displayed more consistent recording practices. Both conventional wisdom and the criminological literature suggests a separation between

---

[19] Data sets are prone to human recording error. In the RCMP Burnaby data set there were several common errors. One error was to mix up the start and end dates. Even though a correction could have been made a decision to discard these incidents as human error was made. There were also several burglaries were the start and end time exceeded any reasonable length. A decision was made to discard all ranges outside a 6-month elapsed time frame. Originally there were 10557 total cases before errors were eliminated.

commercial and residential burglary should be made so this distinction was anticipated.

**Table 4-2: RCMP Incident Reports for Burglary 1998 to 2000**

**RCMP Burglary Incident Reports for the City of Burnaby 1998-2000**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1998 | 2874 | 37.7 | 37.7 | 37.7 |
| | 1999 | 2462 | 32.3 | 32.3 | 70.0 |
| | 2000 | 2288 | 30.0 | 30.0 | 100.0 |
| | Total | 7624 | 100.0 | 100.0 | |

The data were subdivided into commercial and residential categories where exact and range times could be examined in more detail. Examination by month, day, hour and minute was then conducted on start and end times for the range data as well as the exact time data. The commercial and residential burglary range data were then analyzed using the aoristic technique and compared to both exact and start and end times. Finally, mini-simulations of the aoristic technique were used in order to show some of the limitations that arise from this technique.

## *Data Analysis and Results*

### Step 1: Analysis of commercial and residential burglaries

Commercial and residential burglaries were examined to see if a separation into different categories for temporal analysis was necessary. Independent sample t-tests were conducted on exact time as well as range times (start and end times) between commercial and residential burglaries to see if this separation was indeed warranted.[20] Results showed a significant difference in the equality of means at all cones of resolution with the exception of the month level for exact times and range times.

### Whole Data Set

There were 10,266 total police incident reports recorded by police after the data had been cleaned from recording errors between the years 1995-2001.[21] There were 3,295 commercial and 6,931 residential burglaries within the dataset. The month of occurrence was found to be insignificant as a tool for distinguishing between commercial and residential break-ins when analyzed as a whole data set without

---

[20] "Assumptions underlying the T-test for independent samples: 1. Both populations are normal (or, if not, the samples are relatively large). 2. the variances of both populations are the same. This assumption is referred to as the homogeneity of variance assumption" (Vaughan 1998:328).

The t-test for difference between means is used to decide whether the difference between two sample means, is sufficiently large enough to reject the null hypothesis that the means of the two populations are equal. The two samples whose means are to be compared may be independent or correlated (Vaughan, 1998).

[21] This does not reflect all burglaries recorded by police from the years 1995 to 2001. The data set had major recording differences for the years 1995, 1996, 1997 and 2001 from the rest of the years. However, a decision was made to include all burglaries for initial analysis. Further analysis required that only the years 1998, 1999, and 2000 were kept so that comparisons could be made.

separating exact times from range times. At all other levels in the temporal cone of resolution a significant difference was found between the equality of means. The data were then tested at a more detailed level by separating exact times from range times and retesting equality of means between commercial and residential burglary in independent t-tests.

**Exact Time of the Crime**

There were 3,727 burglaries recorded where the exact occurrent times were known. Of those, 1,689 were commercial and 2,038 were residential. Independent samples t-tests were conducted on the month, day, hour, and the time of the day (time based on a 24 hour clock). Significant differences in the equality of means were found between commercial and residential burglary exact times at all levels of temporal resolution.[22]

**Range of Times when Crime could have Occurred**

There were 6,499 recorded burglaries which had crimetime ranges (a start time and an end time). Of those, 1,606 were commercial and 4,893 were residential. Independent samples t-tests were conducted on the month, day, hour, and time of day. Results were different from those for exact times. Month was found to be insignificant in difference between equality of means. Day of week, end time was also insignificant as well start and

---

[22] See Appendix 1

end hours. However, time of day was still found to be significant in its difference in equality of the means.[23]

**Conclusion**: The results of the analysis of exact time and range time between commercial and residential burglary show that each category has significant differences when analyzing the time in which the events occur at all levels in the temporal cone of resolution with the exception of the month level.

**Step 2: Visual Analysis and Significance Testing at various cones of resolution for both residential and commercial burglaries**

Defining the Years of Comparison to 1998 through 2000

As mentioned earlier, the RCMP dataset contained information which fell into the years 1995 to 2001. However, the distribution of cases between those years was dramatically different. This led to a decision to include the years 1998, 1999, and 2000 for comparison analysis (because these years were the most stable in their recording practices) and discard the remaining years. The wide difference in the figures can be primarily traced to the start up of new community policing programs and recording methods by the Burnaby RCMP, which took time for consistent gathering and recording to be implemented. The remainder of the difference is

---

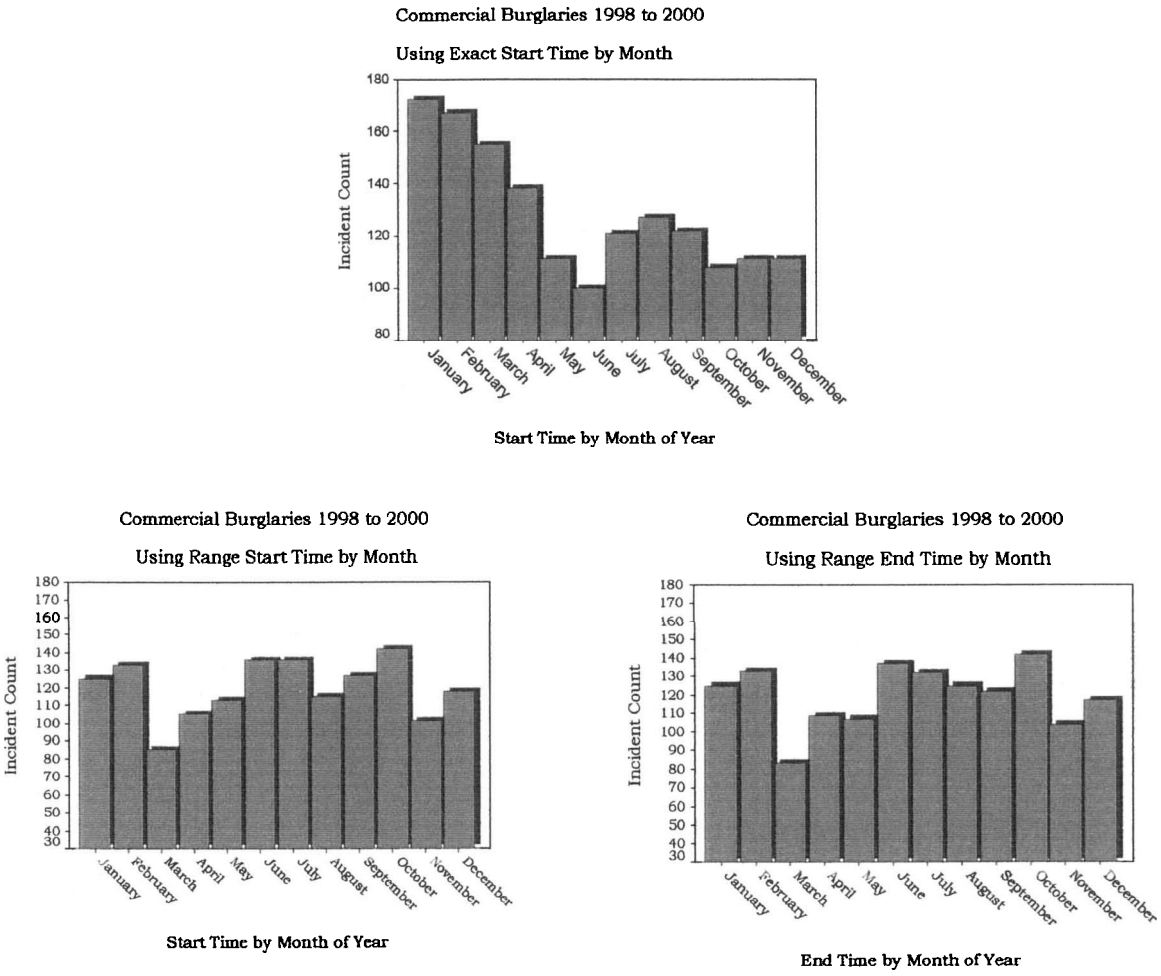
[23] See Appendix 2

found in the cut off points from when the data were first acquired (example: in the year 2001 only half of that years data was given).

**Commercial Burglary**

The commercial burglaries were analyzed by both exact time and range time to give an indication of what was going on at the various temporal levels of resolution. The month, day, hour, and time of day were all graphed and displayed for visualization and comparison. In total there were 2,969 commercial burglaries in the years 1998, 1999, and 2000. There were 1,435 commercial burglaries examined in Burnaby that presented range times (with a potential start and end time recorded) and 1,534 commercial burglaries that had exact crimetimes recorded. More than half of all recorded commercial burglary data were range or time window data. Figures 4-2 to 4-5 show the visualization of commercial burglary at the month, day, hour and time of day level of analysis in graph form. For ease of comparison the exact time graph is displayed on top to allow for easier visual comparison with the range time start and end time graphs below.

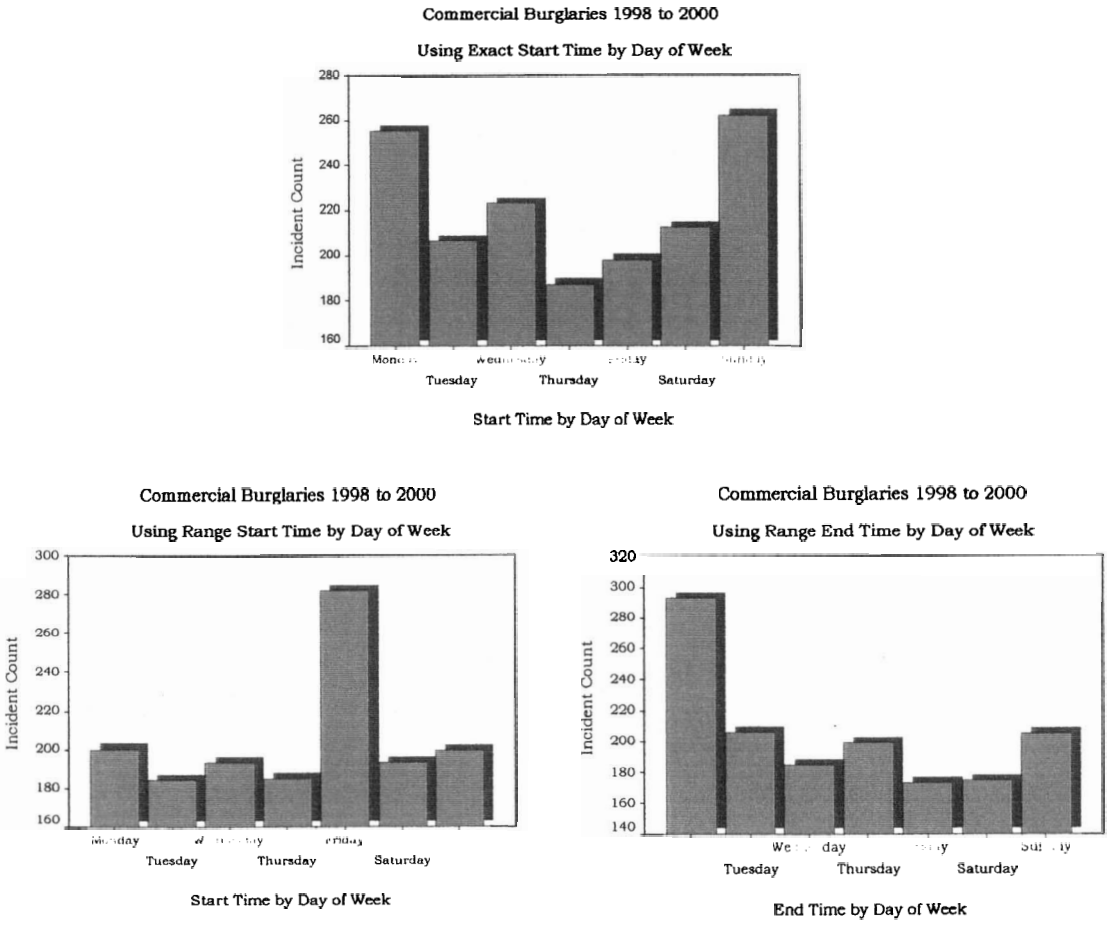
**Figure (4-2): Illustrating Commercial Burglary Month of Occurrence by Exact and Range Times**




Looking at Figure 4-2 suggests that when the exact time is analyzed and the month is known, commercial burglaries peak in the first few months of the year. The months January through April are well above the other months of the year. However, in observing times where there is only a range with a start and end time the monthly pattern is less clear. Paired sample t-tests indicate that on the range time, comparison of start and

end times for the month of the year is not significantly different (t=-.691, df=1435, sig=.469).

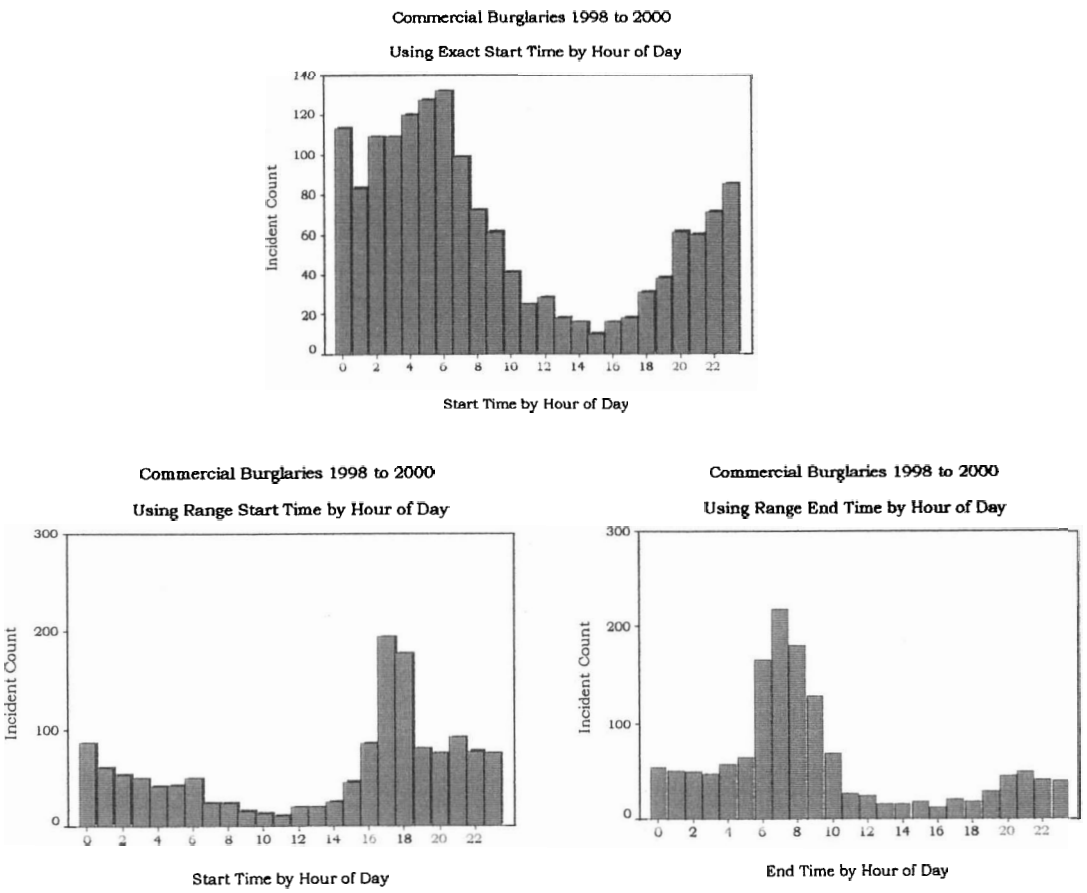
**Figure (4-3): Illustrating Commercial Burglary Day of Occurrence by Exact and Range Times**




In looking at what day of the week commercial burglaries fell on, exact time analysis indicates a peak occurrence on Sunday and Monday. In contrast the range times show start times peaking on Friday and end times peaking on Monday. Paired samples t-tests of the range times for

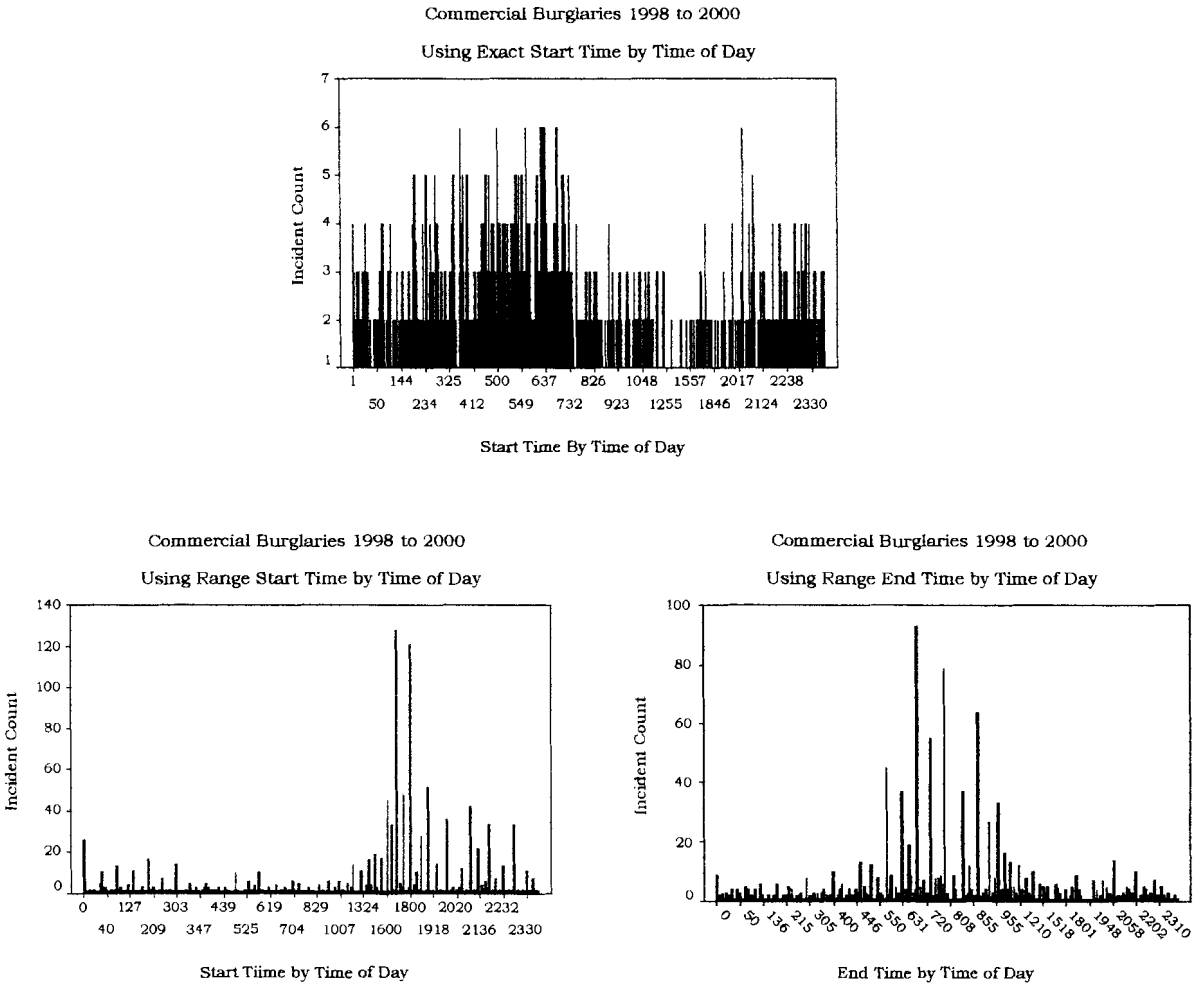
comparison of start and end times showed that there is a significant difference between the two (t=5.922, df=1435, sig=.000). This result suggests significantly different perceptions of when burglary events happen if an individual focuses on either the start or end time alone. This is consistent with a routine activities model prediction that shops and businesses are closed over the weekend, so that is when the commercial establishments get burgled.

**Figure (4-4): Illustrating Commercial Burglary Hour of Occurrence by Exact and Range Times**



Analysis at the hour level for commercial burglary also yields a different perspective depending on whether exact or range times are used. Exact time analysis indicates that most commercial burglaries in Burnaby are done before 8 am and after 8 pm. This tends to support previous research and theory on commercial burglary, which states that these events happen in the evening hours. Analysis of range start and end times, however, gives a dramatically different perspective. It seems that peak hours for commercial burglary are condensed to a smaller time frame 4:30 pm to 7 pm for start times and 6 am to 9 am for end times (these times are significantly different from each other ($t=24.289$, $df=1435$, $sig=.000$). A plausible explanation for this difference could be that the end times and start times are capturing businesses that do not have alarms. This means the end time is when the burglary is discovered and the start time is when the individual best estimates the earliest potential time of occurrence (usually, after the business is closed and everyone has gone home). When an exact time is given, it is likely an indication that the burgled business had an alarm.

**Figure (4-5): Illustrating Commercial Burglary Time of Day Occurrence by Exact and Range Times**




The actual time of day analysis (minute) is similar to hour level analysis but provides a more detailed visual picture for the reader. Commercial burglaries not only happen at night but seem to congregate around 4 pm to 7 pm in the evening for start times (when shops close for the day) and 5:50 am to 9:55 am in the morning for end time (when

businesses open for the day). Again there is a significant difference between start and end time analysis (t=24.082, df 1435, sig=.000). There is also a discrepancy between the exact time analysis and either range time analysis for when these commercial burglaries are occurring. Again, a possible explanation for this may be attributed to the difference between commercial establishments without alarms and commercial establishments with alarms.

**Residential Burglary**

Residential burglary was analyzed by both exact time and range time to give an indication of what was going on at the various levels in the temporal cone of resolution. The month, day, hour, and time of day where all graphed for visualization. In total there were 4,614 residential burglaries in Burnaby over the years 1998, 1999, and 2000. Of those, 1,344 residential burglaries had exact crimetimes captured. The remaining 3,270 residential burglaries had ranges or time windows (a potential start and end time occurrence). Over two thirds (71%) of all residential burglaries studied had crime range time information only.[24]

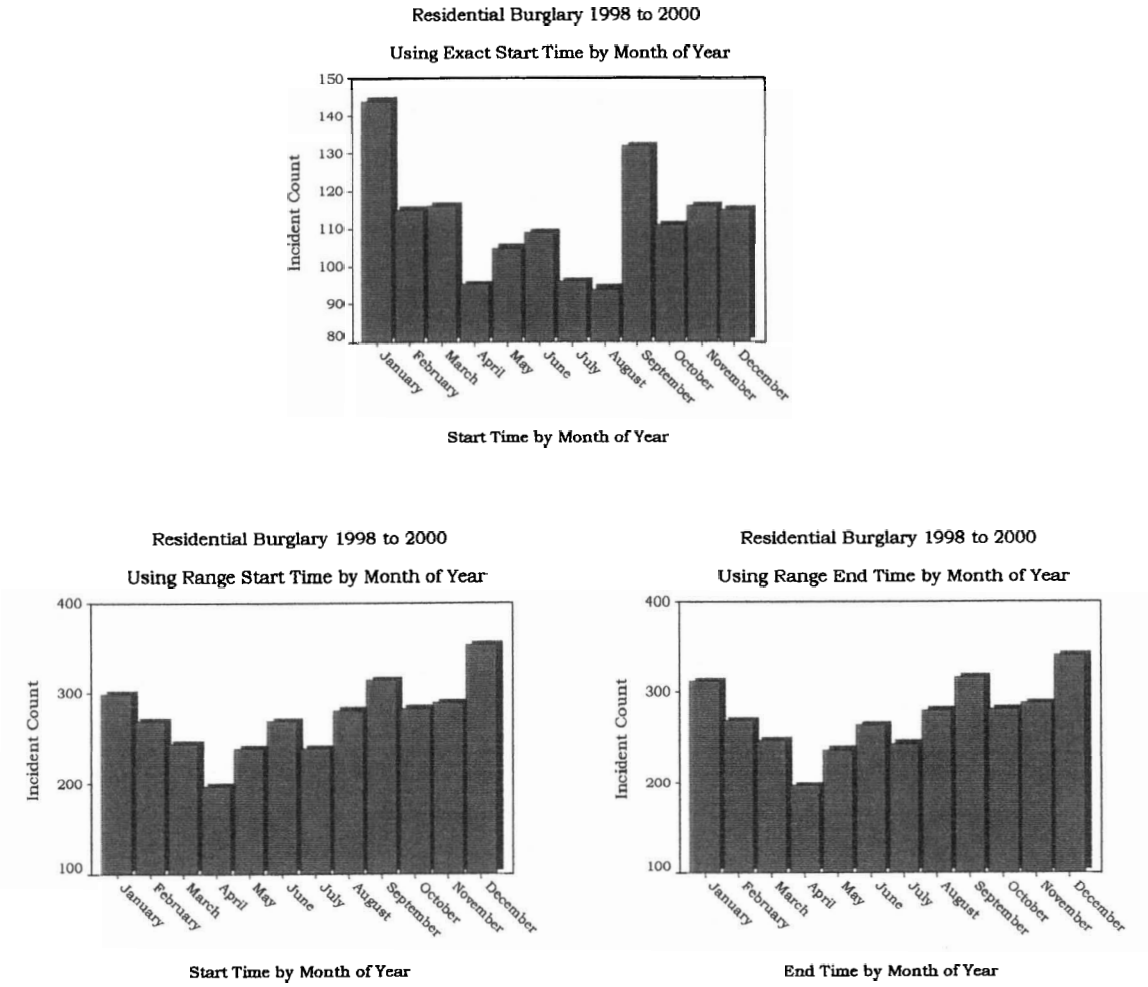
Figures 4-6 to 4-9 visualize residential burglaries at the month, day, hour and time of day level of analysis in graph form. Again, for ease

---

[24] One plausible explanation for why there are so many more residential burglaries range times proportionally than commercial burglaries could result from a higher proportion of commercial establishments having alarms than residential premises.

of comparison the exact time is displayed above to allow for easier visual comparison with range times which are displayed below.

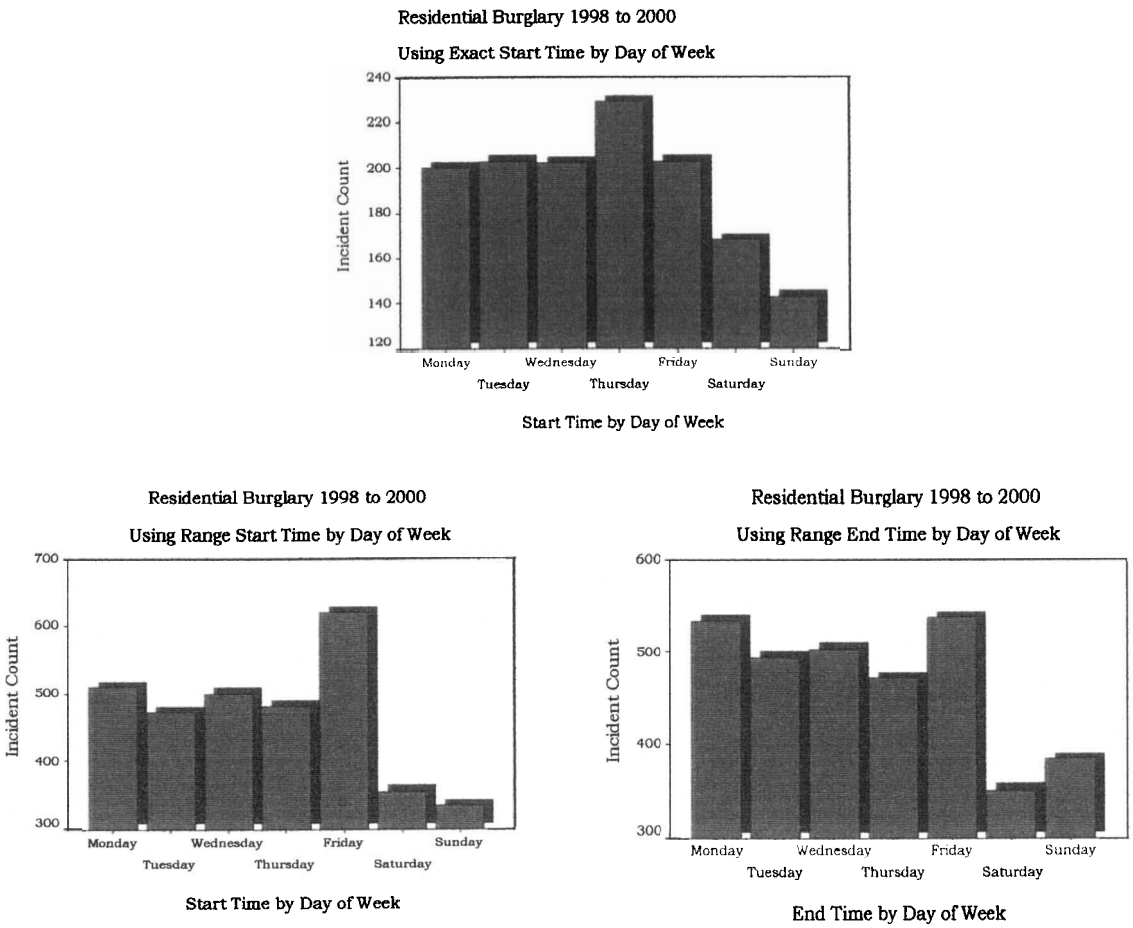
**Figure (4-6): Illustrating Residential Burglary Month of Occurrence by Exact and Range Times**




Residential burglary displays peak monthly occurrence in January and September when looking at exact time data. Analysis of start and end times seem to indicate December as a high month while suggesting April as a low. There is an apparent difference between exact and range time analysis when it comes to residential burglary monthly occurrence.

Analysis and comparison between the start and the end times show little difference visually but when tested there are significant differences between the two (t=2.993, df=3271, sig=.003).

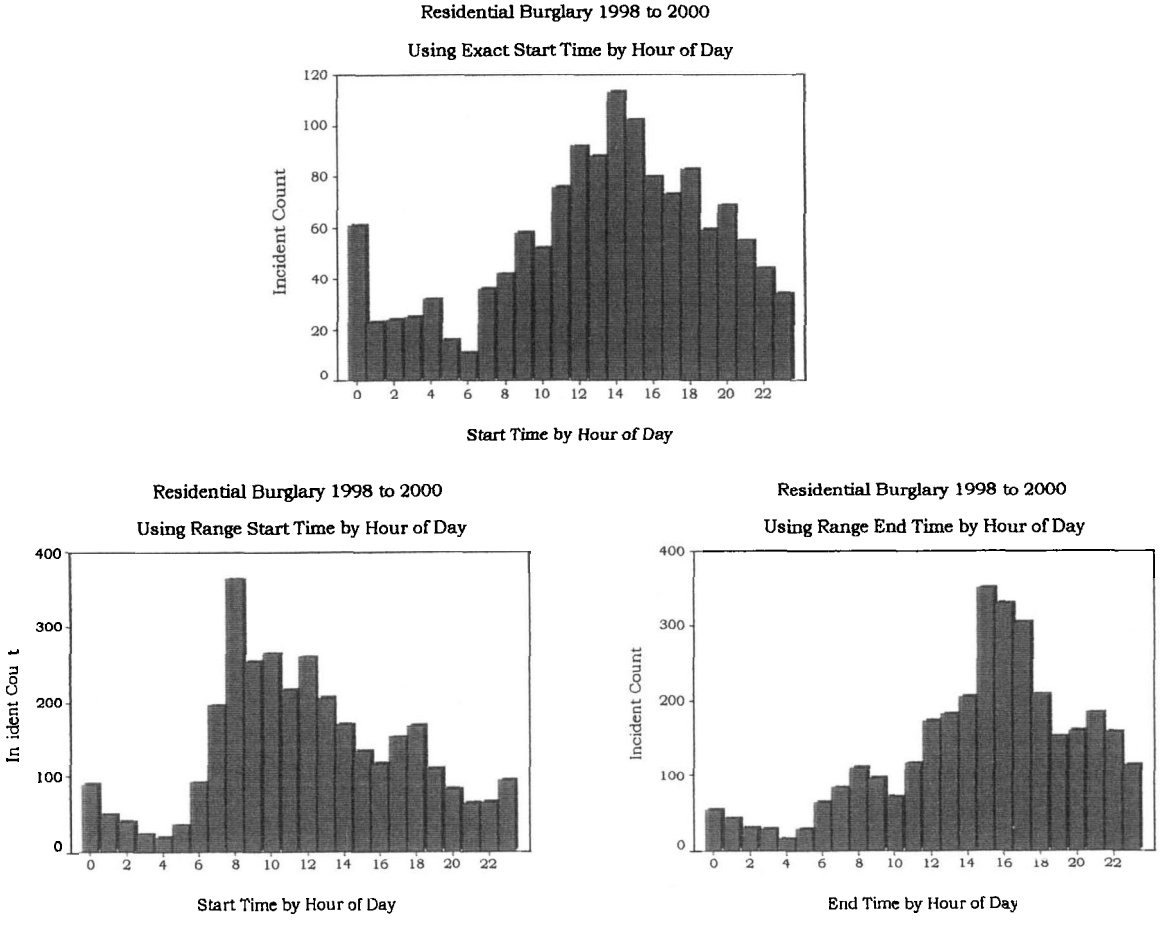
**Figure (4-7): Illustrating Residential Burglary Day of Occurrence by Exact and Range Times**




Analysis of exact time and residential burglary by day of week show heightened periods for burglary during the week with noticeable peaks on Thursday and declining toward the weekend. Range analysis of start and end times projects a very different scenario with Thursday peaks

disappearing entirely. However, the trend towards the crime being committed during the week remains. The apparent Friday peak in start times looks different than end times but upon testing the result is not significant (t=.834, df=3271, sig=.405).

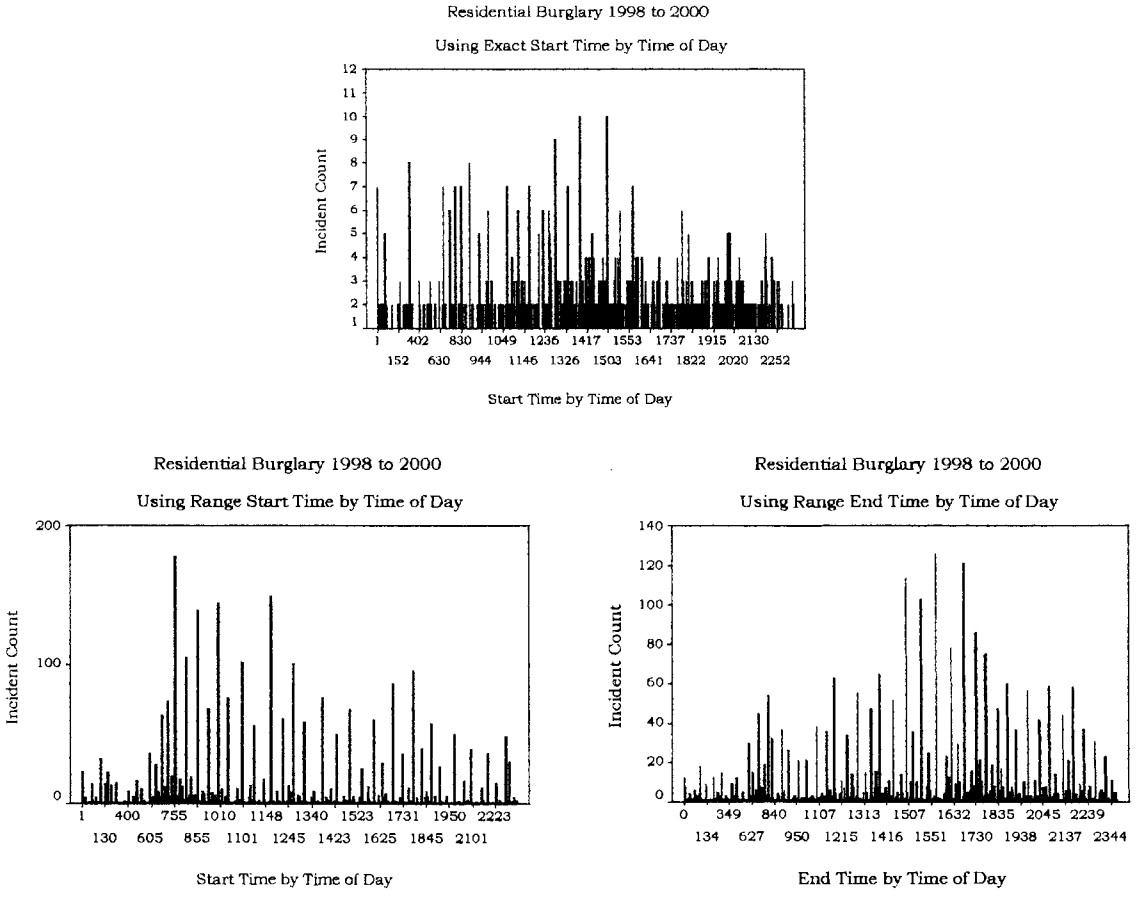
**Figure (4-8): Illustrating Residential Burglary Hour of Occurrence by Exact and Range Times**




Visually, the hour level of analysis for residential burglary appears similar for exact and range times with the exception of a start time peak around 8 am. Other peaks between 3 pm and 5 pm are the same for both

exact and end times. It appears that residential burglaries are occurring most often throughout the day. With the exception of the range start time it appears there is a heightened period from 8 am in the morning and increasing till 3 pm or 4 pm in the afternoon before starting a downward visual trend into the evening. Testing between the start and end times fails to show a significant difference between the two, although visually there appears to be one (t=-1.620, df=3271, sig=.105).

**Figure (4-9): Illustrating Residential Burglary Time of Day Occurrence by Exact and Range Times**



Time of day analysis continues to show daytime trend occurrences for residential burglary. At this detailed level we can see at exact time analysis a fairly stable and frequent conglomeration of residential burglaries from 10 am onward until 4 pm. Range time analysis yields peak periods for start times from 8 am until 11 am and for end times 3 pm until 5:30 pm. The tested difference at the time of day level shows a significant difference between the start and end times (t=17.129, df=3271, sig=.000). This is remarkably consistent with other research done by Wright & Decker (1994); Cromwell (1999); and Cohen and Felson (1979).

**Step 3: Possible Solutions of Range Issue and Techniques Offered**

One way of moving beyond picking either the start time or the end time as the basis of analysis in solving the range issue is to find an average between the two. The problem is not with obtaining the average but finding a theoretical reason for taking the average. For instance, there is not a lot of evidence to suggest taking the average between start and end times for burglary is empirically justified. An example of this is found in the reporting of commercial burglary in the city of Burnaby. Since the majority of start times are initiated on Friday and the end times on Monday averaging between the two leaves you with a time somewhere around Saturday evening. There is no empirical or theoretical support for believing that all these burglaries happen on Saturday evenings in this kind of static fashion.

**Aoristic Technique**

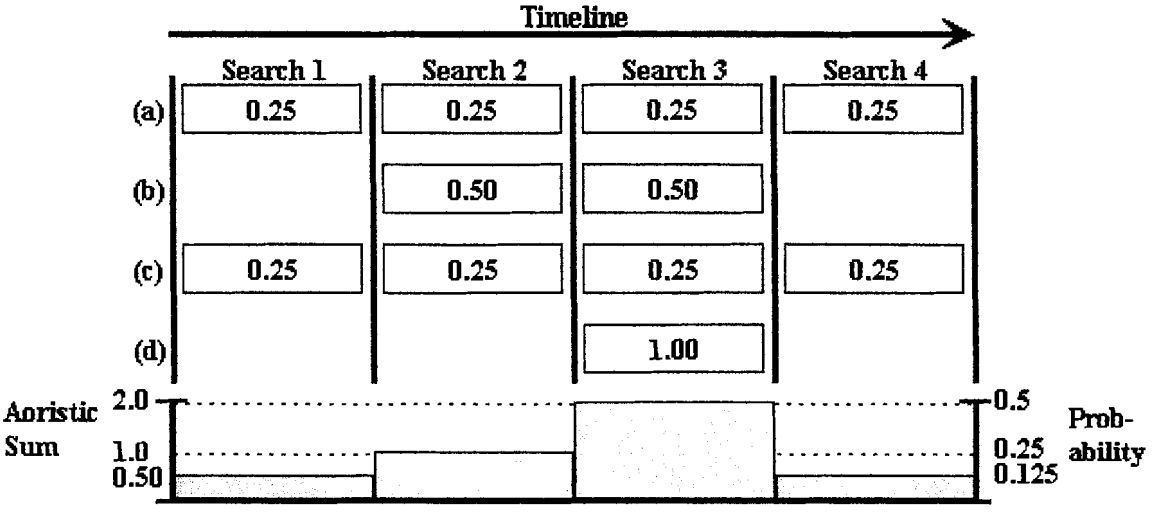
Aoristic analysis is an alternative to the conventional techniques (analysis of start or end time alone or a simple averaging) used in criminology to measure unspecified temporal burglary events. Researchers Ratcliffe and McCullagh coined the term, "aoristic analysis" when it was found that the original term "spatial temporal analysis" was already being used in the field.[25] Jerry Ratcliffe describes aoristic analysis as a technique to be used with time windows that "can provide a temporal weight and give an indication of the probability that an event occurred within a defined period" (Ratcliffe, 2000: 669).

The advantage of the aoristic technique is that it does not have to exclude any temporal possibilities (Ratcliffe, 2000) and incorporates all raw police data including exact times as well as range times. Therefore, all recorded data can be analyzed. This stops the researcher or investigator from throwing out a considerable amount of temporal range data gathered on crimes like burglary and car theft (Ratcliffe, 2000). The result is the ability to "smooth irregularities in the temporal data set and reduce the impact of incongruities such as business opening and closing times" (Ratcliffe, 2000:672). Figure 4-10 allows for a theoretical conceptualization of the technique.

---

[25] As stated in Jerry Ratcliffe's article (2002), Aoristic Signatures, "in a broad sense an aoristic analysis is a spatiotemporal type of inquiry. However, 'spatiotemporal' has a slightly different meaning in the field of geographical information science (GIS)."

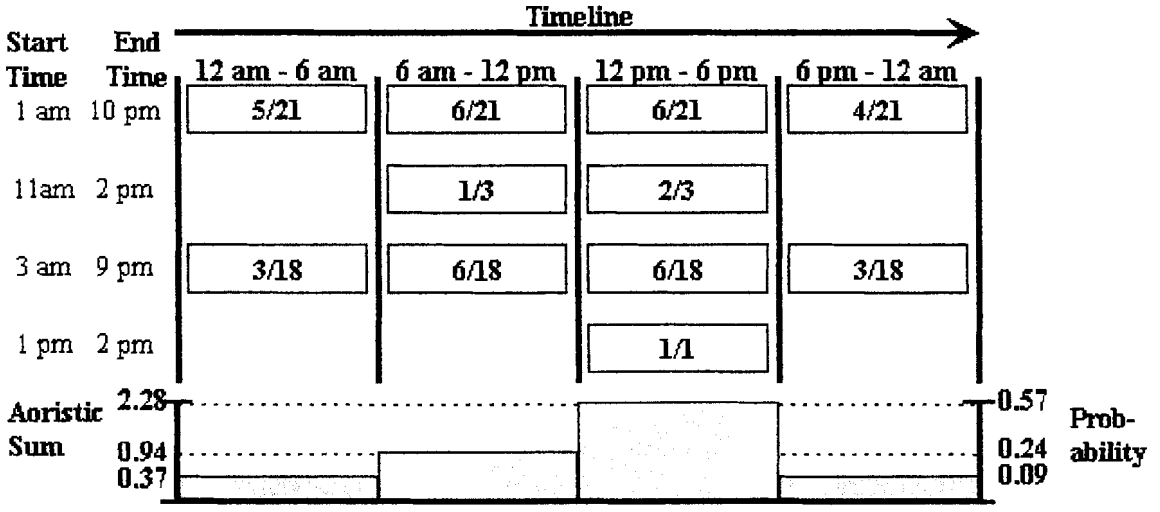
**Figure 4-10: Theoretical Conceptualization of Aoristic Technique**




Across the top of the chart is the overall timeline the events can be fit into. This timeline can fluctuate into different minute, hour, or day boundaries. The important part is that the search block time criteria, as illustrated by search blocks 1-4, is of equal duration (Ratcliffe, 2000). Running vertically to the left of the chart are the individual event time spans which would be recorded per/incident as the example sets out as a, b, c, d and so on. Both the start time and the end time would be shown (a-start, a-end, b-start, b-end, etc.) and those times would expand and contract per criminal event as different ranges have different elapsed times. A calculation would then be made allotting the weighted distribution of the event time range to each search time span. After all events were recorded each column would be added up to show the accumulated weights for all incidents in each proportioned search block.

As with most theoretical representations it is often useful to include a real world example of how data would actually fit into the analysis. Therefore, the following figure will help further illustrate in a pragmatic fashion how the analysis would be done.

**Figure 4-11: Practical Implementation of Aoristic Technique**

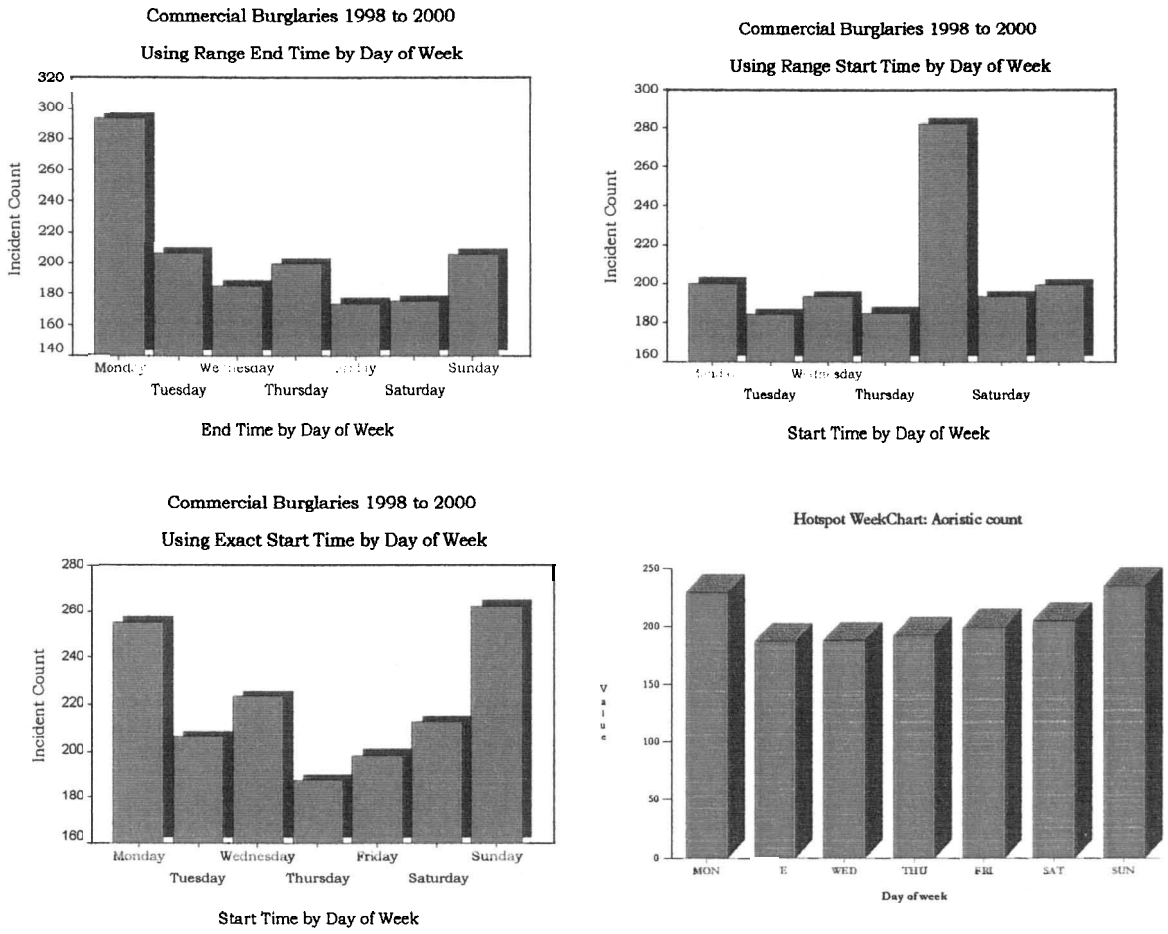



The timeline reflected in the above situation is based on a 24-hour day. As such, 4 search blocks have been established that are of equal duration (12 am to 6 am, 6 am to 12 pm, 12 pm to 6 pm, 6 pm to 12 pm), representing the previous search blocks 1-4. There are four events listed running vertically down the left hand side of the chart all with a start and end time (these are the individual burglary event ranges). The first event occurred between 1 am and 10 pm. That leaves only three hours of the 24-hour day not included in the time window. Therefore, the total time

allotment is calculated over 21 hours (denominator). A fraction is then created by placing the amount of search block time (numerator) filled by the actual range. So in the first search block a 5/21 proportion is allotted because for 5 out of the 6 hours the event filled the time span. This process is continued for the entire data set. At the conclusion of this process the columns are added vertically in each of the search blocks to produce an aoristic sum and probabilistic weight.

Using this approach allows the researcher/practitioner to move beyond taking the start or end time (which are quite different from one another) or some average of the two (which is unsupported in the criminological literature) and instead incorporate all range data into the analysis. It is then appropriate to use the residential and commercial range time burglary data and run it through this technique to see if it yields a different reflection of what is happening than conventional measures.

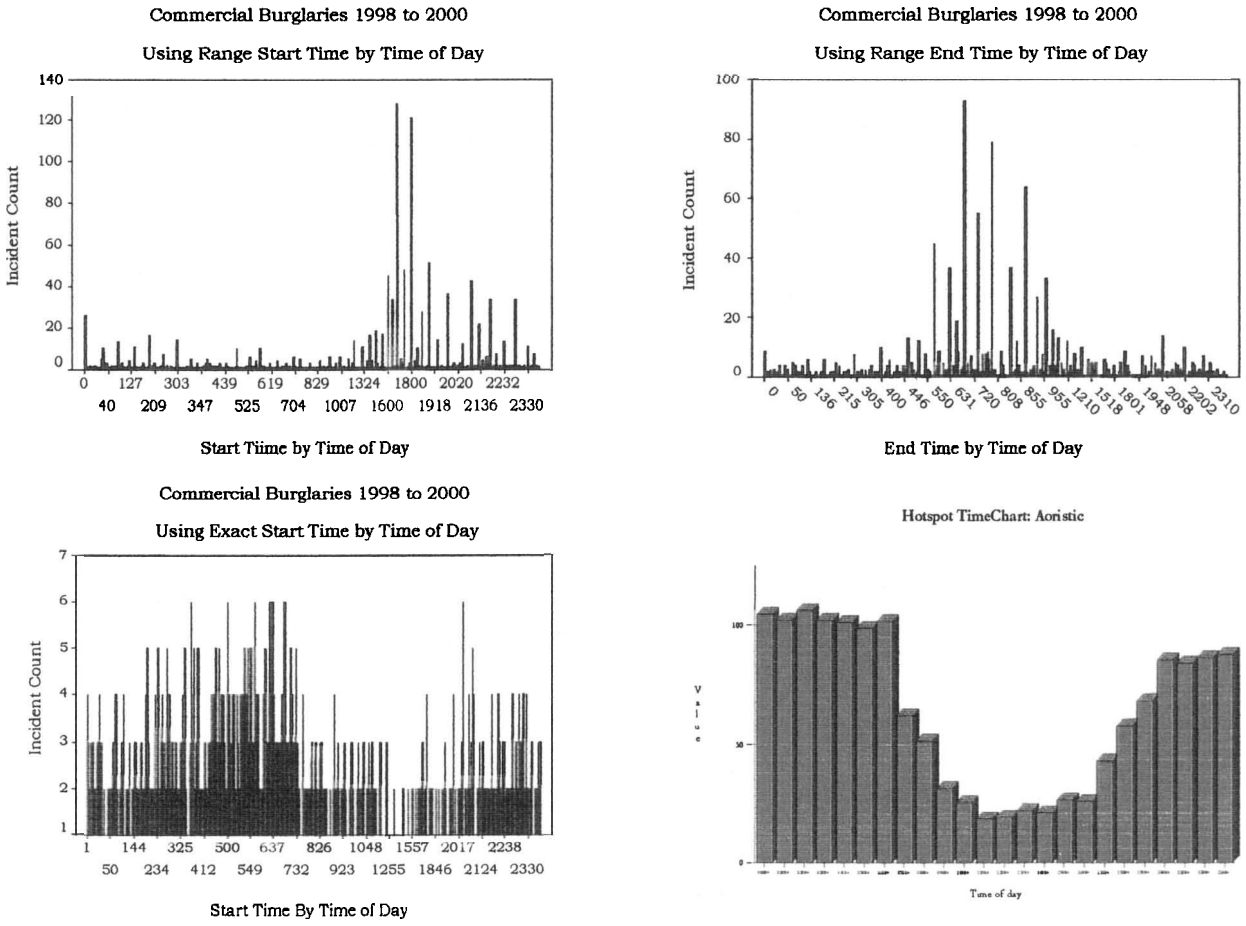
**Figure 4-12: Aoristic Analysis of Commercial Burglary Day of Week with Comparison to Start and End Range Times and Exact Time**




The start and end range times are displayed in the top two graphs in Figure 4-12. The exact time by day of week is displayed in the lower left corner. The new aoristic display is shown in the lower right of the page (in pink). As shown above, the aoristic technique seems to spread the commercial burglaries throughout the weekend. It does not give sharp peaks on Friday (start time) or Monday (end time) but instead sees a gradual increase over the weekend until Monday. It appears to smooth

out the data when compared to the exact time as well. Overall, the aoristic technique confirms and supports the literature in showing that when analyzing range times by the aoristic technique commercial burglaries happen on weekends.

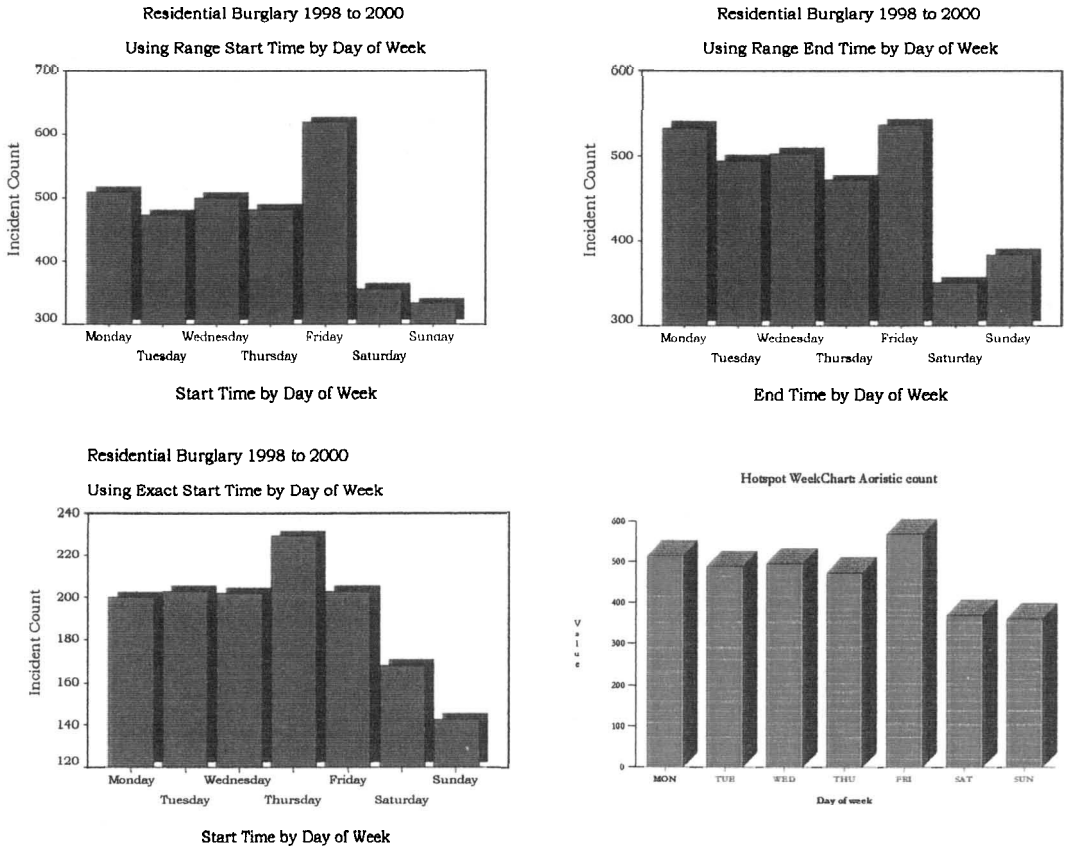
**Figure 4-13: Aoristic Analysis of Commercial Burglary Time of Day with Comparison to Start and End Times**




Displayed in the top 2 graphs in Figure 4-13 are the start and end times of the range. In the lower left corner is the exact time occurrence and to the right (in pink) is the aoristic analysis. At the time of day level,

aoristic analysis again paints a different picture than the start or end times. The aoristic analysis smoothes out the sharp condensed periods of 4 pm to 6 pm (with start time) and the early morning 5:30 am to 9 am (with end time). Aoristic analysis continues to align its analysis of range times with the literature, which suggests commercial burglaries are more frequent during the evenings and less prevalent during the day.

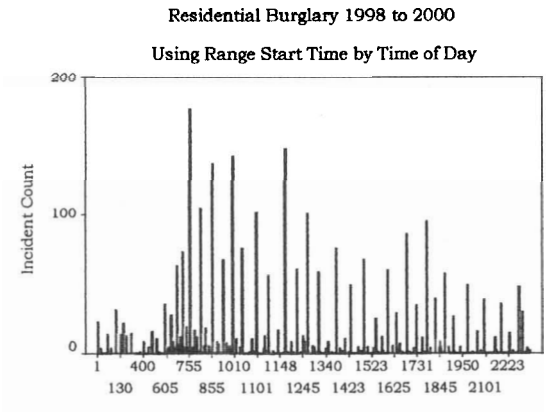
**Figure 4-14: Aoristic Analysis of Residential Burglary Day of Week with Comparison to Start and End Times**

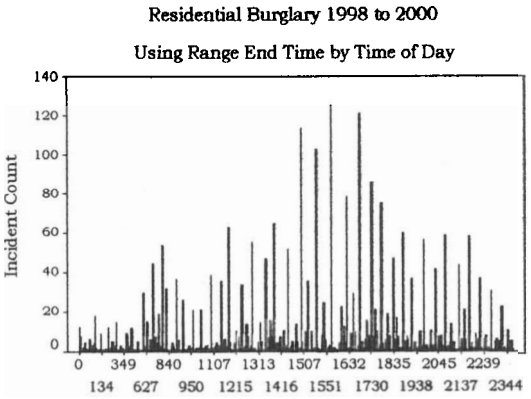


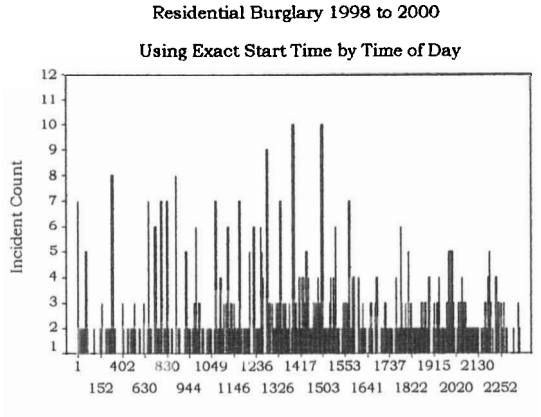

Aoristic analysis on residential burglary by day of week shows a less dramatic decrease for burglaries on the weekend. It appears to hold

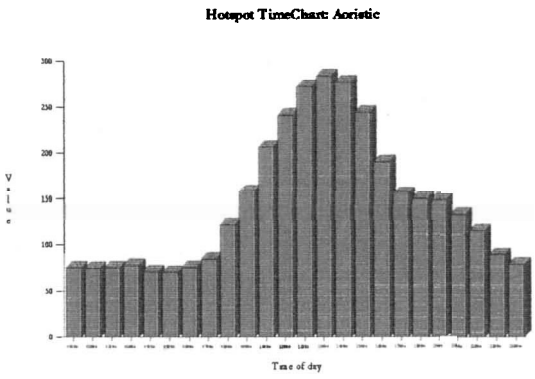
with more activity occurring on Fridays. In applying rational choice opportunity theory, Friday's peak may be the result of people leaving their place of residence to engage in social activities and the burglar being aware of this fact. Again the main impact of aoristic analysis is the smoothing of the data throughout the week.

**Graph 4-15: Aoristic Analysis of Residential Burglary Time of Day with Comparison to Start and End Times**



Aoristic analysis of range time indicates that residential burglaries are predominately happening during the daytime hours. The conglomeration of daytime residential burglaries remains as with analysis of exact times, with the heightened period being established in the afternoon.

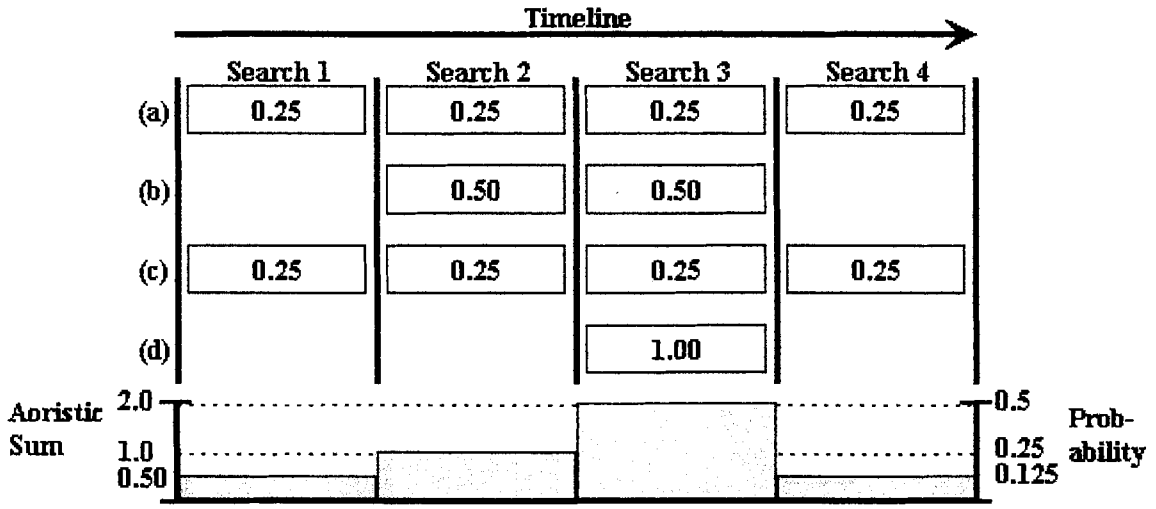
### *Summary of Aoristic Analysis of Commercial and Residential Burglary*

Generally, aoristic analysis yields a different perspective than exact time or start and end time range analysis. Aoristic analysis is able to smooth out dramatic peaks (probably the result of recording bias) shown in conventional analysis, exact time, and start or end time analysis. Aoristic analysis also supports previous literature in suggesting that an analysis of range times seem to point in the direction of what is currently known about commercial and residential break and enters. Range analysis shows commercial burglaries occurring more often on weekends and at night (towards early morning hours) and residential burglaries occurring more often on weekdays and during the day. This does not suggest that there are no burglaries at any other time of the week; it only indicates that there are greater amounts of burglary during these heightened times.

**Step 4: Problems with the Aoristic Technique**

As shown, previous aoristic analysis of range burglary data has a way of smoothing the time of occurrence. It is this smoothing effect which prompted the researcher to take a closer look at exactly what was going on with the technique. Refer for a moment to the theoretical conceptionalization of the aoristic technique (which has been displayed in Figure 4-16). A close examination is required in more detail to try and understand how the aoristic technique is having this smoothing effect on the data. To reflect on this, let us ask the question, what does the aoristic technique do if all the range times are located in just one search block? Or, what happens if the range times are located in all search blocks within 24 hours?

**Figure 4-16: Aoristic Technique: Theoretical Conceptualization**



The aoristic probability calculation can be displayed as follows:

**Formula 4-1: Aoristic Calculation**

Where;

AP = Aoristic Probability

Ki= Number of Exact Times

n = Total Cases

w= Weight

$$AP = \frac{n - k_i}{n} w + \frac{k_i}{n}$$

$$AP = \left(1 - \frac{k_i}{n}\right) w + \frac{k_i}{n}$$

$$1 - \frac{k_i}{n} \equiv proportion\ of\ unknown\ times$$

$$\frac{k_i}{n} \equiv proportion\ of\ known\ times$$

As shown in Figure 4-16, if the burglary (time range) occurred within one search block only (example: (d) search block 3), that search block is assigned a unit of 1. Hypothetically, if all range times fell within that one search block the aoristic weight would fall singularly into that area of probability leaving only that area shown to be occurring. This can be conceptualized in the following formula:

**Formula 4-2: High proportion of Known Times**

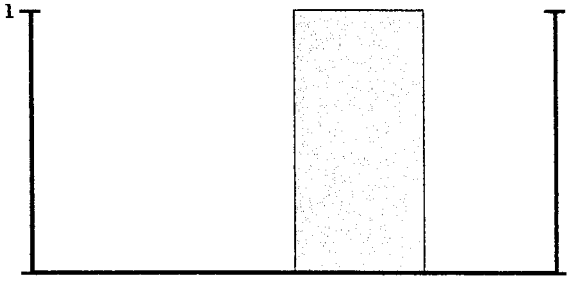
$$\frac{n-k_i}{n} \rightarrow 0 \quad and \quad \frac{k_i}{n} \rightarrow 1$$

$$AP = \frac{k_i}{n}$$

Where n is equal to the total number of cases and $k_i$ is equal to the number of known times (exact times) the result is 0.

This can be seen when we hypothetically substitute a single case with a known time (exact time). If we then had one case with one known time we would use the total number of cases, 1, minus the number of known times, 1, divided by the number of cases: (1-1) / 1 which would equal 0. Where n is equal to the total number of cases and $k_i$ is equal to the number of known cases the result is 1. This can also be seen when we substitute a single case exact time into the formula. If one known time is divided by the total number of cases the result is one. Therefore, the aoristic probability is one. Graphically the aoristic probability of one exact time case and one overall case would look like the following:

**Graph 4-1: Aoristic Probability for One Case of Known Time**




The result has been an aoristic display that assigns probability solely to that one search block area[26].

Conversely, referring back to our Figure 4-16, when burglary ranges are distributed equally across all search blocks (example: c - search blocks 1-4), each block is assigned an equal distribution of the total one. In the example this leaves an assigned weight of 0.25 in each search block, therefore distributing this result equally across all search blocks. This can also be displayed in a formula as the following:

**Formula 4-3: High proportion of Unknown Times**

$$\frac{n-k_i}{n} \rightarrow 1 \quad and \quad \frac{k_i}{n} \rightarrow 0$$

$$AP = w$$

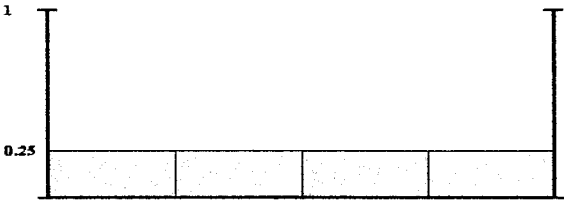
---

[26] In anticipating a questions like; Since this is only one case and its exact time is known – of course the AP=1, so why would you bother to do the calculation? The answer is you wouldn't. However, in order to show the bias in the technique towards the unknown times it is important to understand what the technique is doing to both known and unknown times. This is especially true as investigators may analyze both known and unknown times together as the information is held in the same police database.

Where n is equal to the total number of cases and $k_i$ is equal to the number of unknown times the result is reversed.

If we substitute a single case into the formula, one total case minus one unknown case: (1-0) /1 the result is 1. And if we substitute a known case, 0, divided by the total number of cases the result is zero. The result is that the aoristic probability is equally distributed across all search blocks leaving a flat line affect. This can be clearly illustrated in the following graph.

**Graph 4-2: Aoristic Probability of One Equally Distributed Range Case**



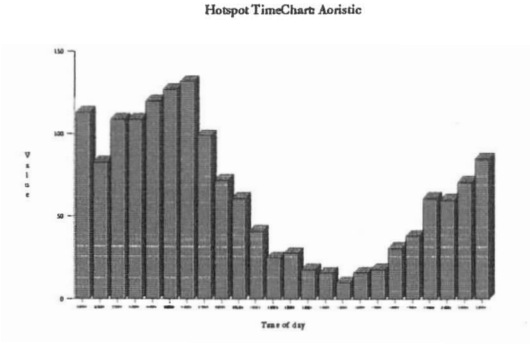

The reader may now ask, "so what does this all mean?" The answer comes when you consider the following. If a majority of police data collected on burglaries is range data (data without a precise time), what would happen if the majority of range time data collected was longer than the total search block criteria? In referring to Graph 4-2, this would suggest that the aoristic technique would have a tendency to flat line the data towards all search blocks. The results would be a smoothing trend.

There would be bias in what the techniques did with ranges that fell inside all search blocks.

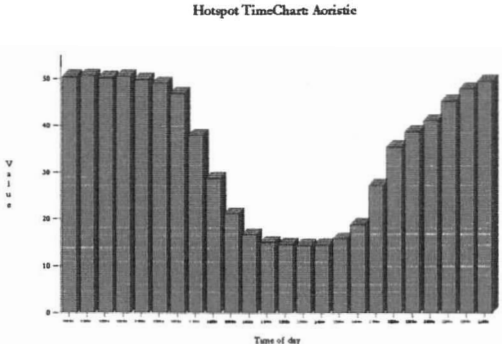
To test this with the Burnaby RCMP data, a mini-simulation was run on commercial and residential burglary data sets to see if this bias could be simulated with real world data. Aoristic analysis was again run on the two datasets but this time breaking up the analysis into elapsed time segments of 100, 500, 1000 and 1440 minute ranges of the day. Figures 4-17 and 4-18 show the result, as narrower time ranges were removed and only lengthy time ranges remained. The result was that a breakdown occurred for both commercial and residential datasets.

**Figure 4-17: Aoristic Breakdown of Commercial Burglary 100, 500, 1000, and 1440 minutes**

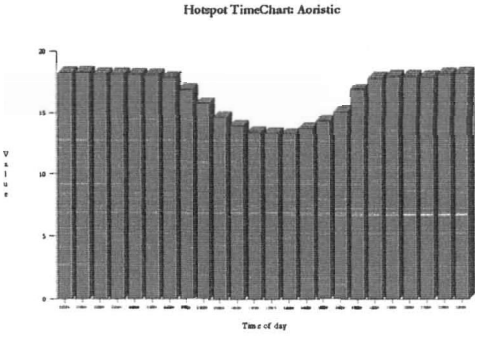
**Removal of Commercial B&E 100 Minutes or Less**




**Removal of Commercial B&E 500 Minutes or Less**




**Removal of Commercial B&E 1000 Minutes or Less**




**Removal of Commercial B&E 1440 Minutes or Less**

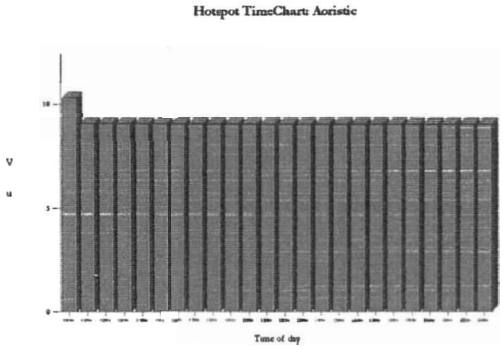
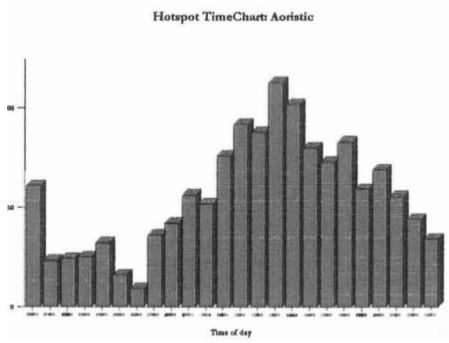
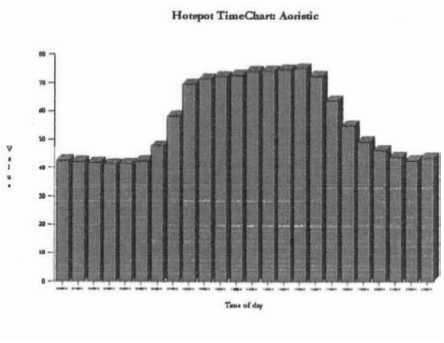


**Figure 4-18: Aoristic breakdown of Residential Burglary 100, 500, 1000, 1440**

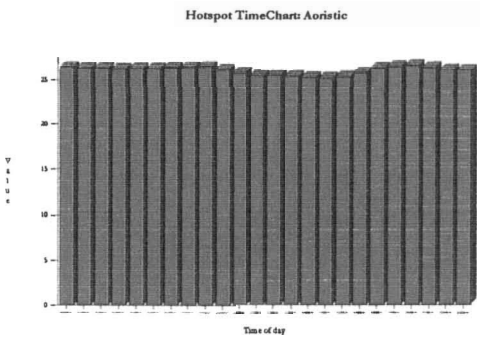
**Removal of Residential B&E 100 Minutes or Less**



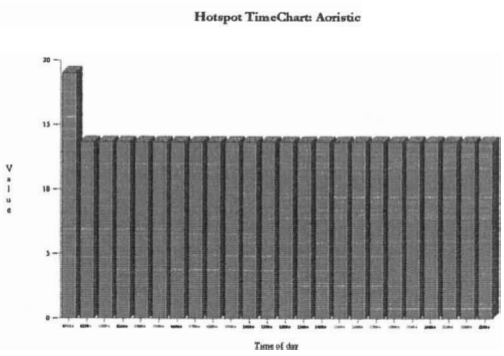

**Removal of Residential B&E 500 Minutes or Less**




**Removal of Residential B&E 1000 Minutes or Less**




**Removal of Residential B&E 1440 Minutes or Less**




## Inherent Limitations of the Aoristic Technique

The inherent limitations of the aoristic technique are that when the number of exact and unknown times fluctuate dramatically the technique is biased towards the significantly greater proportion of that type of time data (the inherent bias is towards unknown times[27]). So when the exact

[27] Martin Andresen (2003). "Some Mathematical Properties of Aoristic Analysis"

times are significantly greater than the unknown times the tendency will be biased towards the search block in which the majority of exact times fall. Where the unknown times are significantly greater than the known times then the bias will be towards an equal distribution of all search block areas. It is this second bias that is of the greatest concern when dealing with real world data, as police data are mostly made up of range times and of those, a significant proportion fall outside a 24-hour period in length.

Smoothing may have some value. However, if the researcher or practitioner was not aware of such tendencies when the majority of data fell beyond the total time in the search block, they may be misled in their analysis.

### *Summary of Results*

Generally, the temporal patterns found in this study agreed with previous research when looking at commercial and residential burglary. Commercial burglary seemed to gravitate towards the weekends in the late-night/early-morning hours. Residential burglaries occurred during the week in the mid-morning or mid-day hours.

In trying to incorporate time ranges for analysis it was found that the aoristic measures, although significantly different from the start or end time of recorded occurrence, were very similar to exact time analysis.

Problems inherent within aoristic analysis may cause errors in placing emphasis and significance on the results. It appears that currently in criminology range or window analysis of start and end times within the crime of burglary cannot be analyzed with certainty.

# Chapter 5: Discussion/Recommendations and Summary

When looking at the temporal components involved in the crime of burglary it is important to separate burglary into residential and commercial categories. Each of these categories has significant time differences in when they occur. It is important when looking at time ranges or windows for the researcher to recognize start and end times yield significantly different results. Neither one nor the other should be used independently as they will each yield very different perceptions, neither of which is completely accurate on its own. Unless future evidence is brought forward there is little theoretical reason to pick either the start or end time as an appropriate launch point of temporal analysis for the crime of burglary.

Conventional averaging between start and end times also fails to be supported by any theoretical or pragmatic evidence of its real world relevance. Simple averaging cannot be supported. New techniques seem to hold more promise. Aoristic analysis is a tool that provides insight into the large amount of police data for burglary that contains range times (time windows). Results of aoristic analysis, however, indicate that there are inherent limitations to the technique's ability to handle disproportionate data sets. However, aoristic analysis is a better way to get at a 'time average' of unspecified criminal events than previous conventional methods. Aoristic analysis allows the researcher and

criminal justice investigator to explore the time range problem in a way that could not be done previously. In seeing how burglary is dispersed in time allows criminal justice personnel to allocate resources according to their own crime prevention strategy. Again it moves beyond a start and end time analysis to give a clearer picture of when burglaries are going on in any particular city.

Aoristic analysis does not, however, give the researcher or criminal justice practitioner the ability to discover why various cities or areas differ in their aoristic results. The technique also requires that the data set be structured in such a way as to not fall into its inherent number limit bias. Ultimately then, the technique is narrow in its focus and demands that the analyst be familiar with the apparent problems that can be encountered.

## *Practitioner and Academic Direction*

### Police

The aoristic technique serves as a good tool to deal with the 40% to 70% of the data which do not have an exact time of occurrence. The technique is the best technique criminology has available at this point to deal with the issue. There may still be utility for strategic police initiatives in aoristic analysis even given its limitations. As Jerry Ratcliffe has said,

> The application of aoristic analysis can aid police officers to understand better the temporal pattern of high volume crime and plan patrols and crime prevention strategy accordingly (Ratcliffe, 2000:678).

However, it is important to realize the limitations of the aoristic technique in doing analysis and to be sensitive to the variations in datasets that exist in the criminal justice sector.

**Academics**

We should not be completely satisfied that the aoristic technique can solve the time range window problem. Although an advance has been made, major limitations in dealing with longer ranges as well as limitations in how to compare the difference between separate cities prevent this technique from being the final solution to the problem. The field of criminology has to articulate its problems to those who are more knowledgeable in the area. Statisticians and mathematicians need to be called on to develop a way to handle this issue.[28] Until better techniques and measures are put forward, analysis of exact time is probably the best bet for researchers. Unfortunately this means losing 40% to 70% of the data we currently have stored in most criminal justice databases.

**Conclusion**

Environmental criminology is the best orientating strategy used within the field of criminology. It is better than other theories because it incorporates all elements of the criminal event. It is better because it

---

[28] Currently, there is promise in new measures being put forward by Martin Andresen using multinomial logistic regression as an alternative to the aoristic technique.

provides testable ideas for theoretical advancement and conceptualization. It is better because it translates into practical policies and prevention initiatives. It is better because it responds to law enforcement and community problems, offering solutions not only for tomorrow, but for today as well. Finally, this strategy is both inclusive and friendly to Western democratic beliefs and values – it makes no attempt to circumvent the current social political system but rather works within the system to best understand the principles and patterns that make up the crime.

Understanding the temporal components calls for recognition of the distinct categories of commercial and residential break and enter events. It is unfortunate that at this time the majority of information collected on the temporal occurrence of range burglary events is limited to narrow analysis measures. Future advances in technology and statistical measures may hold promise that this issue can be resolved. The pioneering work in this field done by Jerry Ratcliffe has provided new issues and problems for criminology and reminds researchers there is much work yet to be done. Future advances with time and burglary will be able to show better how burglaries are distributed in space and time and incorporate all data produced by criminal justice agencies.

## Appendix 1: Independent Samples T-Test between Commercial and Residential Burglary Exact Times

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| Month Numeric1 | Equal variances assumed | 3.441 | .064 | -2.349 | 3725 | .019 | -.28 | .118 | -.511 | -.046 |
| | Equal variances not assumed | | | -2.342 | 3552.751 | .019 | -.28 | .119 | -.511 | -.045 |
| Day of Week | Equal variances assumed | 37.282 | .000 | 3.407 | 3725 | .001 | .22 | .065 | .095 | .351 |
| | Equal variances not assumed | | | 3.376 | 3444.777 | .001 | .22 | .066 | .093 | .352 |
| Time Numeric1 | Equal variances assumed | 166.657 | .000 | -19.601 | 3725 | .000 | -425.88 | 21.728 | -468.482 | -383.284 |
| | Equal variances not assumed | | | -19.180 | 3179.681 | .000 | -425.88 | 22.205 | -469.420 | -382.346 |
| Time Hours1 | Equal variances assumed | 165.637 | .000 | -19.744 | 3725 | .000 | -4.28 | .217 | -4.707 | -3.856 |
| | Equal variances not assumed | | | -19.320 | 3179.673 | .000 | -4.28 | .222 | -4.716 | -3.847 |
| Total Minutes1 | Equal variances assumed | 167.053 | .000 | -19.498 | 3725 | .000 | -254.62 | 13.059 | -280.225 | -229.019 |
| | Equal variances not assumed | | | -19.079 | 3180.123 | .000 | -254.62 | 13.345 | -280.788 | -228.456 |

# Appendix 2: Independent Samples T-Test between Commercial and Residential Burglary Range Times

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| Month Numeric1 | Equal variances assumed | 2.645 | .104 | .402 | 6497 | .688 | .04 | .104 | -.163 | .247 |
| | Equal variances not assumed | | | .405 | 2770.879 | .686 | .04 | .104 | -.161 | .245 |
| Month Numeric2 | Equal variances assumed | 2.060 | .151 | .667 | 6497 | .505 | .07 | .104 | -.135 | .274 |
| | Equal variances not assumed | | | .672 | 2765.769 | .502 | .07 | .104 | -.134 | .273 |
| Day of Week | Equal variances assumed | 5.527 | .019 | 5.290 | 6497 | .000 | .29 | .055 | .184 | .400 |
| | Equal variances not assumed | | | 5.194 | 2653.763 | .000 | .29 | .056 | .182 | .402 |
| Day of the Week2 | Equal variances assumed | 29.912 | .000 | -.156 | 6497 | .876 | -.01 | .057 | -.121 | .103 |
| | Equal variances not assumed | | | -.150 | 2577.891 | .881 | -.01 | .059 | -.125 | .107 |
| Time Numeric1 | Equal variances assumed | 244.678 | .000 | 8.050 | 6497 | .000 | 164.40 | 20.423 | 124.369 | 204.440 |
| | Equal variances not assumed | | | 7.083 | 2268.293 | .000 | 164.40 | 23.210 | 118.890 | 209.920 |
| Time Numeric2 | Equal variances assumed | 1.949 | .163 | -24.230 | 6497 | .000 | -594.02 | 24.516 | -642.080 | -545.960 |
| | Equal variances not assumed | | | -29.809 | 4218.657 | .000 | -594.02 | 19.927 | -633.088 | -554.952 |
| Time Hours1 | Equal variances assumed | .664 | .415 | .570 | 6497 | .569 | 6.90 | 12.110 | -16.835 | 30.645 |
| | Equal variances not assumed | | | .546 | 2549.314 | .585 | 6.90 | 12.653 | -17.905 | 31.715 |
| Time Hours2 | Equal variances assumed | 3.054 | .081 | -1.290 | 6497 | .197 | -24.89 | 19.295 | -62.713 | 12.935 |
| | Equal variances not assumed | | | -2.251 | 4893.794 | .024 | -24.89 | 11.054 | -46.561 | -3.217 |
| Total Minutes1 | Equal variances assumed | 589.908 | .000 | 9.455 | 6497 | .000 | 95.77 | 10.129 | 75.917 | 115.629 |
| | Equal variances not assumed | | | 7.994 | 2161.930 | .000 | 95.77 | 11.980 | 72.280 | 119.266 |
| Total Minutes 2 | Equal variances assumed | 18.231 | .000 | -36.251 | 6497 | .000 | -344.16 | 9.494 | -362.769 | -325.547 |
| | Equal variances not assumed | | | -34.149 | 2489.183 | .000 | -344.16 | 10.078 | -363.920 | -324.396 |

## Appendix 3: Descriptive Statistics for Commercial Burglary Exact Times

**Descriptive Statistics**

| | N | Range | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| Month Numeric1 | 1543 | 11 | 1 | 12 | 6.01 | 3.534 |
| Month Numeric2 | 1543 | 11 | 1 | 12 | 6.01 | 3.534 |
| Day of Week | 1543 | 6 | 1 | 7 | 4.01 | 2.092 |
| Day of Week2 | 1543 | 6 | 1 | 7 | 4.01 | 2.092 |
| Time Hours1 | 1543 | 23 | 0 | 23 | 8.96 | 7.415 |
| Time Hours2 | 1543 | 23 | 0 | 23 | 8.96 | 7.415 |
| Time Numeric1 | 1543 | 2358 | 0 | 2358 | 924.73 | 742.859 |
| Time Numeric2 | 1543 | 2358 | 0 | 2358 | 924.73 | 742.859 |
| Valid N (listwise) | 1543 | | | | | |

## Appendix 3: (a) Descriptive Statistics and Paired T-Test Results of Difference for Commercial Burglary Ranges

**Descriptive Statistics**

| | N | Range | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| Month Numeric1 | 1436 | 11 | 1 | 12 | 6.55 | 3.431 |
| Month Numeric2 | 1436 | 11 | 1 | 12 | 6.56 | 3.432 |
| Day of Week | 1436 | 6 | 1 | 7 | 4.07 | 1.970 |
| Day of Week2 | 1436 | 6 | 1 | 7 | 3.76 | 2.093 |
| Time Hours1 | 1436 | 23 | 0 | 23 | 13.58 | 7.427 |
| Time Hours2 | 1436 | 23 | 0 | 23 | 9.09 | 6.006 |
| Time Numeric1 | 1436 | 2355 | 0 | 2355 | 1373.41 | 739.477 |
| Time Numeric2 | 1436 | 2359 | 0 | 2359 | 929.52 | 600.364 |
| Valid N (listwise) | 1436 | | | | | |

## Appendix 3(b): Paired Samples T-Test for Commercial month, day, hour, time of day

**Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| Pair 1 | Month Numeric1 - Month Numeric2 | -.01 | .534 | .014 | -.04 | .02 | -.691 | 1435 | .489 |
| Pair 2 | Day of Week - Day of Week2 | .31 | 1.969 | .052 | .21 | .41 | 5.922 | 1435 | .000 |
| Pair 3 | Time Hours1 - Time Hours2 | 4.49 | 7.003 | .185 | 4.13 | 4.85 | 24.289 | 1435 | .000 |
| Pair 4 | Time Numeric1 - Time Numeric2 | 443.89 | 698.476 | 18.432 | 407.73 | 480.05 | 24.082 | 1435 | .000 |

## Appendix 4: Descriptive Statistics for Residential Burglary Exact Times

**Descriptive Statistics**

| | N | Range | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| Month Numeric1 | 1344 | 11 | 1 | 12 | 6.43 | 3.573 |
| Month Numeric2 | 1344 | 11 | 1 | 12 | 6.43 | 3.573 |
| Day of Week | 1344 | 6 | 1 | 7 | 3.82 | 1.915 |
| Day of Week2 | 1344 | 6 | 1 | 7 | 3.82 | 1.915 |
| Time Hours | 1344 | 23 | 0 | 23 | 13.12 | 5.956 |
| Time Hours2 | 1344 | 23 | 0 | 23 | 13.12 | 5.956 |
| Time Numeric1 | 1344 | 2359 | 0 | 2359 | 1339.05 | 597.738 |
| Time Numeric2 | 1344 | 2359 | 0 | 2359 | 1339.05 | 587.738 |
| Valid N (listwise) | 1344 | | | | | |

## Appendix 4(a): Descriptive Statistics and Paired Samples T-Test For Residential Burglary Range Times

**Descriptive Statistics**

| | N | Range | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| Month Numeric1 | 3270 | 11 | 1 | 12 | 6.76 | 3.572 |
| Month Numeric2 | 3270 | 11 | 1 | 12 | 6.72 | 3.575 |
| Day of Week | 3270 | 6 | 1 | 7 | 3.80 | 1.907 |
| Day of Week2 | 3270 | 6 | 1 | 7 | 3.79 | 1.956 |
| Time Hours | 3270 | 23 | 0 | 23 | 11.92 | 5.342 |
| Time Hours2 | 3270 | 23 | 0 | 23 | 14.68 | 5.301 |
| Time Numeric1 | 3270 | 2359 | 0 | 2359 | 1206.96 | 534.345 |
| Time Numeric2 | 3270 | 2359 | 0 | 2359 | 1486.99 | 531.257 |
| Valid N (listwise) | 3270 | | | | | |

## Appendix 4(b): Paired Samples T-Test for Residential Burglary month, day, hour, time of day.

**Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| Pair 1 | Month Numeric1 - Month Numeric2 | .04 | .777 | .014 | .01 | .07 | 2.993 | 3271 | .003 |
| Pair 2 | Day of Week - Day of Week2 | .02 | 1.237 | .022 | -.02 | .06 | .834 | 3271 | .405 |
| Pair 3 | Time Hours - Time Hours2 | -21.45 | 757.296 | 13.239 | -47.41 | 4.50 | -1.620 | 3271 | .105 |
| Pair 4 | Time Numeric1 - Time Numeric2 | -297.59 | 993.780 | 17.373 | -331.65 | -263.53 | -17.129 | 3271 | .000 |

## References


Bartol, C. (1995). Criminal Behavior: A Psychosocial Approach. (4ed). Englewood Cliffs, New Jersey: Prentice Hall.

Brantingham, P. J., & Brantingham, P. L. (1984). Patterns in crime. NewYork: Macmillan.

Brantingham, P. J., & Brantingham, P. L. (Eds.). (1991). Environmental Criminology (1981 reissue). Prospect Heights, IL: Waveland Press.

Brantingham, P. L., & Brantingham, P. J. (1993). Nodes, paths, and edges: considerations on the complexity of crime and the physical environment. Journal of Environmental Psychology, 13, pp 3-28.

Brantingham, P. L., & Brantingham, P. J. (1995). Criminality of Place: Crime Generators and Crime Attractors. European Journal on Crime Policy and Research: Special Issue on Crime, Environment, and Situational Prevention 3:1-19.

Brantingham, P. L., & Brantingham, P. J. (1996). Environment, Routine and Situation: Toward a Pattern Theory of Crime. To appear in Advances in Criminological Theory, Volume 5, 1993.

Brantingham, P. L., & Brantingham, P. J. (1996). The Theory of CPTED. Presented at the American Society of Criminology, Chicago: November 1996.

Brantingham, P. L., & Brantingham, P. J. (2000). A Conceptual Model for Anticipating Crime Displacement. Presented at the American Society of Criminology San Francisco, February, 2000.

Brantingham, P. L., & Brantingham, P. J. (2000). Police use of environmental criminology in strategic crime prevention. Police Practice, 1, (2), pp 211-240.

Brantingham, P.J., & Easton, S.T., (1996). The Crime Bill: How much and who pays? Fraser Forum Critical Issues Bulletin (February). Vancouver, B.C.:The Fraser Institute.

Brantingham, P.J. and Faust, F.L. (1976). A Conceptual Model of Crime Prevention. Crime and Delinquency. 22, 273-284.

Canadian Centre for Justice Statistics (2001). Canadian Crime Statistics Catalogue no. 85-205-XIE. Ottawa, Ontario.

Chimbos, P. (1975). A Study of Breaking and Entering Offences in "Northern City" Ontario. Crime in Canadian Society. Toronto, Canada: Butterworth.

Clarke, R. (1997). Situational Crime Prevention: Successful Case Studies (2ed). Albany, New York: Harrow and Heston.

Cohen L., & Felson, M. (1979). Social Change and Crime rate trends: A Routine Activities Approach. American Sociological Review. Albany: New York.

Cornish, D., & Clarke, R. (1986). The Reasoning Criminal: Rational Choice Perspectives on Offending. New York: Springer-Verlag.

Crettenden, I. (1985). Break and Enter Offenders in South Australia. Burglary: A Social Reality. Proceedings of Seminar on Burglary 24-27 June. Australian Institute of Criminology: Canberra.

Cromwell, P. (1999). In Their own Words: Criminals on Crime (2ed). Los Angeles, California: Roxbury.

Cromwell, P., Olson, J. & Avary, D.W. (1991). Breaking and Entering: An Ethnographic Analysis of Burglary. Studies in Crime, Law and Justice Vol. 8. Newbury Park, California: Sage.

Engstad, P. (1975). Environmental Opportunities and the Ecology of Crime. Crime in Canadian Society. Toronto, Canada: Butterworth.

Felson, M. (1994). Crime and Everyday Life: Insights and Implications for Society. Thunder Oaks, California: Pine Forge Press.

Figlio, R., Hakim, S. & Rengert, G. (1986). Metropolitan Crime Patterns. Monsey, New York: Criminal Justice Press.

Fukuyama, F. (1999). The Great Disruption: Human Nature and the Reconstruction of Social Order. New York: Free Press.

Gottfredson, D. M. (1989). Criminological theories: the truth as told by Mark Twain. In Advances in Criminological Theory, Volume 1, edited by William S. Laufer and Freda Alder, pp. 1-16. Transaction Publishers.

Gottfredson, M., & Hirschi, T. (1990). A General Theory of Crime. Stanford, California: Standford University Press.

Goff, C. (2001). Criminal Justice in Canada (2ed). Scarbourough, Ontario

Harper, N. J. (1985). Opening Address. The Honourable Minister for Justice and the Attorney-General Queensland Burglary: A Social Reality. Proceedings of Seminar on Burglary 24-27 June. . Mukherjee, S., & Jorgensen, L. (Ed.). Australian Institute of Criminology: Canberra.

Newman, O. (1972). Defensible Space. New York: MacMillian.

Maguire, M., & Bennett, T. (1982). Burglary in a Dwelling: The Offence, the Offender and the Victim. Heinemann: London.

Matthews, R. & Young, J. (1986). Confronting Crime. London: Sage Publications

Mawby, R. (2001). Burglary. Devon, UK: Willan.

McGrath, D. (1981) The Social Psychology of Time: New Perspectives. Sage

Mukherjee, S., & Jorgensen, L. (Ed.) (1985). Burglary: A Social Reality. Proceedings of Seminar on Burglary 24-27 June. Australian Institute of Criminology: Canberra.

Mukherjee, S. (1985). Nature and Extent of Burglary in Australia. Burglary: A Social Reality. Proceedings of Seminar on Burglary 24-27 June. Australian Institute of Criminology: Canberra.

Pope, C. (1975). The Judicial Processing of Assault and Burglary Offenders in Selected California Counties. (U.S. Department of Justice. Law Enforcement Assistance Administration. National Criminal Justice Information and Statistics Service. Analytic Report 10) Albany, New York: Criminal Justice Research Center.

Pope, C. (1977). Crime-Specific Analysis: The Characteristics of Burglary Incidents. (U.S. Department of Justice. Law Enforcement Assistance Administration. National Criminal Justice Information and Statistics Service. Analytic Report 10) Albany, New York: Criminal Justice Research Center.

Pope, C. (1977). Crime-Specific Analysis: An Empirical Examination of Burglary Offense and Offender Characteristics. (U.S. Department of Justice. Law Enforcement Assistance Administration. National Criminal Justice Information and Statistics Service. Analytic Report 12) Albany, New York: Criminal Justice Research Center.

Ratcliffe, J. (2000). Aoristic analysis: the spatial interpretation of unspecified temporal events. Int. J. Geographical Information Science, Vol 14, No 7, 669-679.

Ratcliffe, J. (2002). Aoristic Signatures and the Spatio-Temporal Analysis of High Volume Crime Patterns. Journal of Quantitative Criminology, Vol. 18, No. 1, March 2002.

Ratcliffe, J., & McCullagh, M. (1998). Aoristic Crime Analysis. Int. J. Geographical Science, Vol. 12, No. 7, 751-764.

Reppetto, T. (1974). Residential Crime. Cambridge, MA: Ballinger.

Rengert, G., & Wasilchick, J. (1985). Suburban Burglary: A Time and a Place for Everything. Springfield, Illinois: Charles C Thomas.

Sacco, V., & Kennedy, L. (1997). The Criminal Event (2ed). Scarborough, Ontario: Nelson.

Scarr, H., Pinsky, J. & Wyatt, D. (1973). Patterns of Burglary (2ed). (U.S. Department of Justice. Law Enforcement Assistance Administration. National Institute of Law Enforcement and Criminal Justice). McLean, Virginia: Human Sciences Research.

Skogan, W. (1990). Disorder and decline: crime and the spiral of decay in American neighbourhoods. New York: Free Press.

Shover, N., & Honaker, D. (1990). The Criminal Calculus of Persistent Property Offenders: A Review of Evidence. Paper presented at the Forty-second Annual Meeting of the American Society of Criminology, Baltimore, November

Taylor, N., & Mayhew, P. (2002). Financial and Psychological Costs of Crime for Small Retail Businesses. Australian Institute of Criminology: Trends and Issues in Crime and Criminal Justice. No. 229, 1-6. Canaberra, Austrialia.

Tarling, R. and Davidson, T. (2000). Victims of Domestic Burglary: A Review of the Literature. London: Victim Support.

Tremblay, S. (1999). Crime Statistics in Canada, 1998. Ottawa: Juristat.

Waller, I., & Okihiro, N. (1978). Burglary: the Victim and the Public. Toronto: University of Toronto Press.

Walsh, D. (1980). Break-ins: Burglary From Private Houses. Constable: London.

Winchester, S., & Jackson, H. (1982). Residential Burglary: the limits of prevention. London: Her Majesty's Stationary Office (Home Office Research Study no. 74)

Wright, R., & Decker, S. (1994). Burglars on the Job: Streetlife and Residential Break-ins. Northeastern University Press: Boston.

White, G. (1990). Neighborhood permeability and the burglary rates. Justice Quarterly, 7, (1), pp, 57-67.

Young, J. (1986). The Failure of Criminology: The Need for a Radical Realism. Confronting Crime. Ed Roger Matthews and Jock Young London: Sage Publications

# SIMON FRASER UNIVERSITY

OFFICE OF RESEARCH ETHICS

BURNABY, BRITISH COLUMBIA
CANADA V5A 1S6
Telephone: 604-291-4370
FAX: 604-291-4860

September 16, 2002

Mr. Greg Jenion
Graduate Student
Department of Criminology
Simon Fraser University

Dear Mr. Jenion:

**Re: Temporal Analysis of the Burglary Phenomenon**

I am pleased to inform you that the above referenced Request for Ethical Approval of Research has been approved on behalf of the Research Ethics Board. This approval is in effect for twenty-four months from the above date. Any changes in the procedures affecting interaction with human subjects should be reported to the Research Ethics Board. Significant changes will require the submission of a revised Request for Ethical Approval of Research. This approval is in effect only while you are a registered SFU student.

Your application has been categorized as "minimal risk" and approved by the Director, Office of Research Ethics, on behalf of the Research Ethics Board in accordance with University policy R20.0, http://www.sfu.ca/policies/research/r20-01.htm. The Board reviews and may amend decisions made independently by the Director, Chair or Deputy Chair at its regular monthly meetings.

Best wishes for success in this research.

Sincerely,

Dr. Hal Weinberg, Director
Office of Research Ethics

c: P. Brantingham, Supervisor

/bjr