GEOGRAPHIC PROFILING:
TARGET PATTERNS OF SERIAL MURDERERS

by

Darcy Kim Rossmo
M.A., Simon Fraser University, 1987

DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

in the School
of
Criminology

© Darcy Kim Rossmo 1995
SIMON FRASER UNIVERSITY
October 1995

All rights reserved. This work may not be reproduced in whole or in part, by photocopy or other means, without permission of the author.
Name: Darcy Kim Rossmo
Degree: Doctor of Philosophy
Title of Dissertation: Geographic Profiling: Target Patterns of Serial Murderers

Examining Committee:
Chair: Joan Brockman, LL.M.

Senior Supervisor
Professor, School of Criminology

John Lowman, PhD
Professor, School of Criminology

John C. Yuille, PhD
Professor, Department of Psychology
University of British Columbia

Tony Calvert, PhD, P.Eng.
Internal External Examiner
Professor, Department of Computing Science

Ronald V. Clarke, PhD
External Examiner
Dean, School of Criminal Justice
Rutgers University

Date Approved: October 13, 1995
PARTIAL COPYRIGHT LICENSE

I hereby grant to Simon Fraser University the right to lend my thesis, project or extended essay (the title of which is shown below) to users of the Simon Fraser University Library, and to make partial or single copies only for such users or in response to a request from the library of any other university, or other educational institution, on its own behalf or for one of its users. I further agree that permission for multiple copying of this work for scholarly purposes may be granted by me or the Dean of Graduate Studies. It is understood that copying or publication of this work for financial gain shall not be allowed without my written permission.

Title of Thesis/Project/Extended Essay

Geographic Profiling: Target Patterns of Serial Murderers

Author:

Darcy Kim Rossmo

(date) 95.11.07

(signature)
This PhD dissertation is an analysis of the spatial patterns produced by the hunting behaviour and target locations of serial murderers. Hunting behaviour refers to the victim search and attack processes engaged in by an offender, while target locations are the various geographic sites connected to a crime series. For serial murder these include victim encounter, attack, murder, and body dump sites. The patterns and methods of serial killer hunting activity were analyzed from a geography of crime perspective, and the Brantingham and Brantingham model of crime site selection used as a means of conceptualizing the relationship between offender activity space and crime site location.

This study had three specific purposes which were, in increasing order of importance: (1) to add to the knowledge of serial murder; (2) to examine the geography of serial murder at both macro and microlevels; and (3) to construct a method for determining the most probable area of offender residence from the locations of the crimes. The dissertation research has subsequently led to the development of geographic profiling, an information management strategy for serial violent crime investigation.
Increased knowledge of the spatial behaviour of serial killers can assist in the investigation of their murders in a variety of ways. Police strategies resulting from a geographic profile have included: (1) prioritization of suspects by area for investigative follow-up; (2) augmentation of psychological profiles with information on offender movement; (3) geographic deployment of directed patrol efforts; and (4) searches of computer databases by address or postal/zip code.

Serial killers are rare, but when they do strike the public and the criminal justice system are both significantly affected. Beyond the violence and tragedy of the crimes, serial murder produces tremendous fear levels in the community, generates heavy pressures for investigating agencies, and demands significant resources from police, courts, and prisons. Consequently, research that adds to our understanding of how and where these violent predators hunt their victims has both practical and theoretical implications.
DEDICATION

Dedicated to those who chase the hunters.
“It is quite a three-pipe problem.”

Sherlock Holmes, in *The Red-Headed League*,

Sir Arthur Conan Doyle, 1891.
ACKNOWLEDGMENTS

Like much academic research, this study is the product of the work of many people in addition to the author. First and foremost I would like to thank my PhD committee for their support and guidance: Professor Paul Brantingham, my supervisor, School of Criminology, Simon Fraser University; Professor John Lowman, School of Criminology, Simon Fraser University; and Professor John Yuille, Department of Psychology, University of British Columbia.

I would also like to acknowledge the encouragement and assistance of the following researchers and authors: Professor Eric Hickey, Department of Criminology, California State University; Professor Steven Egger, Criminal Justice Program, Sangamon State University; Professor James LeBeau, Center For the Study of Crime, Delinquency, and Corrections, Southern Illinois University; Professor George Rengert, Department of Criminal Justice, Temple University; Jonathan Alston, School of Criminology, Simon Fraser University; Anne Davies, Police Research Group, Home Office; and Doctor Janet Jackson, NISCALE.

As an investigative technique, geographic profiling owes a debt to the following police officers: Chief Constable Ray Canuel, Vancouver Police
Department; Inspector Ken Doern, Community Services Section, Vancouver Police Department; Staff Sergeant Doug MacKay-Dunn, Vancouver Integrated Intelligence Unit; Inspector Ron MacKay, Violent Crime Analysis Branch, Royal Canadian Mounted Police; Corporal Keith Davidson, Violent Crime Unit, Royal Canadian Mounted Police; Dr. Roland Reboussin, Investigative Support Unit, Federal Bureau of Investigation; Sergeant John House, Criminal Investigation Division, Royal Newfoundland Constabulary; Corporal Guy Pollock, Coordinated Law Enforcement Unit Intelligence Section; and Corporal Steve Hess, Police Academy, Justice Institute of British Columbia.

Supervisory Special Agent Judson Ray, Behavioral Science Unit, Federal Bureau of Investigation, facilitated the initial data collection from the National Center for the Analysis of Violent Crime. Janice Campbell-Barnett, Kim Bufton, Rebecca Wall, Laurie Henderson, Rose Chow, and Kevin Bonnycastle all supplied invaluable research assistance. A debt of gratitude must also go to Lieutenant Debra Davidoski, District 5, Milwaukee Police Department. And the students of my Crim 414/6 class, The Phenomenon of Serial Murder, more than adequately demonstrated that learning occurs on both sides of the podium.

Finally, a special thanks to Ian Laverty, MacDonald Dettwiler and Associates, whose programming expertise and advice made this research possible.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPROVAL</td>
<td>ii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>v</td>
</tr>
<tr>
<td>QUOTATION</td>
<td>vi</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xiv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xvi</td>
</tr>
<tr>
<td>LIST OF EQUATIONS</td>
<td>xix</td>
</tr>
<tr>
<td>FOREWORD</td>
<td>xxi</td>
</tr>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>II. SERIAL MURDER</td>
<td>6</td>
</tr>
<tr>
<td>The Phenomenon of Serial Murder</td>
<td>6</td>
</tr>
<tr>
<td>Incidence and Population Estimates</td>
<td>8</td>
</tr>
<tr>
<td>The Increase of Serial Murder</td>
<td>16</td>
</tr>
<tr>
<td>Definitions and Typologies</td>
<td>20</td>
</tr>
<tr>
<td>Theories of Serial Murder</td>
<td>28</td>
</tr>
<tr>
<td>Victimology</td>
<td>51</td>
</tr>
<tr>
<td>Serial Murder Investigation</td>
<td>60</td>
</tr>
<tr>
<td>Investigative Difficulties</td>
<td>60</td>
</tr>
</tbody>
</table>

ix
III. THE GEOGRAPHY OF CRIME

Geography and Crime Studies

Centrography
Nearest Neighbour Analysis
Movement and Distance
Mental Maps
  Awareness and Activity Spaces
  Anchor Points
Journey to Crime Research

Environmental Criminology

The Brantingham and Brantingham Model of
Crime Site Selection

Crime Site Geography and Target Patterns
  Hunting Grounds
  Target Backcloth
  Crime Locations
  Offender Type
  Method of Victim Disposal
  Learning and Displacement

Geography and Crime Investigation
VI. DISCUSSION

Implications for the Geography of Crime
Geographic Profiling

The Profiling Process
Profile Considerations
Operational Procedure

Investigative Strategies
Suspect Prioritization
Patrol Saturation and Static Stakeouts
Neighbourhood Canvasses
Police Information Systems
Outside Agency Databases
Postal Code Prioritization
Task Force Computer Systems
Violent Sex Offender Registries
Peak-of-Tension Polygraphy
Bloodings
Trial Court Expert Evidence

VII. CONCLUSION

APPENDICES
A. SERIAL MURDER DATA SET
B. DATA CODING FORMS
C. DATA CODING GUIDELINES
D. GEOGRAPHIC PROFILING REQUIREMENTS

BIBLIOGRAPHY
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Characteristics of the Holmes and De Burger Serial Murderer Typology</td>
</tr>
<tr>
<td>2</td>
<td>Journey to Crime Research</td>
</tr>
<tr>
<td>3</td>
<td>Selection Criteria for Microlevel Data Set</td>
</tr>
<tr>
<td>4</td>
<td>Serial Killer Hunting Typology and Geographic Analysis Feasibility</td>
</tr>
<tr>
<td>5</td>
<td>Serial Murderer Characteristics</td>
</tr>
<tr>
<td>6</td>
<td>Serial Murder Figures by State</td>
</tr>
<tr>
<td>7</td>
<td>Serial Murder Rates by State</td>
</tr>
<tr>
<td>8</td>
<td>Serial Killer Data</td>
</tr>
<tr>
<td>9</td>
<td>Serial Murder Victim Data</td>
</tr>
<tr>
<td>10</td>
<td>Serial Murder Location Data</td>
</tr>
<tr>
<td>11</td>
<td>Crime Site Patterns (Victim Encounter Sites)</td>
</tr>
<tr>
<td>12</td>
<td>Point Pattern Analysis (Victim Encounter Sites)</td>
</tr>
<tr>
<td>13</td>
<td>CGT Results (Victim Encounter Sites)</td>
</tr>
<tr>
<td>14</td>
<td>Crime Site Patterns (Victim Encounter/Body Dump Sites)</td>
</tr>
<tr>
<td>15</td>
<td>Point Pattern Analysis (Victim Encounter/Body Dump Sites)</td>
</tr>
<tr>
<td>16</td>
<td>CGT Results (Victim Encounter/Body Dump Sites)</td>
</tr>
<tr>
<td>17</td>
<td>Crime Site Patterns (Body Dump Sites)</td>
</tr>
<tr>
<td>18</td>
<td>Point Pattern Analysis (Body Dump Sites)</td>
</tr>
<tr>
<td>Page</td>
<td>Title</td>
</tr>
<tr>
<td>------</td>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td>19</td>
<td>CGT Results (Body Dump Sites)</td>
</tr>
<tr>
<td>20</td>
<td>CGT Comparative Site Type Results</td>
</tr>
<tr>
<td>21</td>
<td>Urban Population Density</td>
</tr>
<tr>
<td>22</td>
<td>Crime Location Sets</td>
</tr>
<tr>
<td>23</td>
<td>Crime Trip Distance Increase</td>
</tr>
<tr>
<td>A-1</td>
<td>FBI Serial Murderer Macrolevel Data Set</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Crime Site Search Geography</td>
<td>147</td>
</tr>
<tr>
<td>2</td>
<td>Distance-Decay Function</td>
<td>149</td>
</tr>
<tr>
<td>3</td>
<td>Raptor Target Pattern</td>
<td>209</td>
</tr>
<tr>
<td>4</td>
<td>Stalker Target Pattern</td>
<td>210</td>
</tr>
<tr>
<td>5</td>
<td>Journey to Crime Venn Diagram</td>
<td>218</td>
</tr>
<tr>
<td>6</td>
<td>Isopleth Map – Railway Killer</td>
<td>227</td>
</tr>
<tr>
<td>7</td>
<td>Choropleth Map – Railway Killer</td>
<td>228</td>
</tr>
<tr>
<td>8</td>
<td>Geoprofile Map</td>
<td>229</td>
</tr>
<tr>
<td>9</td>
<td>Distribution of Confirmed and Suspected Victim Numbers by Case</td>
<td>234</td>
</tr>
<tr>
<td>10</td>
<td>Crime Site Point Pattern – Richard Chase</td>
<td>248</td>
</tr>
<tr>
<td>11</td>
<td>Isopleth Map – Richard Chase (All Sites)</td>
<td>249</td>
</tr>
<tr>
<td>12</td>
<td>Choropleth Map – Richard Chase (All Sites)</td>
<td>250</td>
</tr>
<tr>
<td>13</td>
<td>Crime Site Point Pattern – Albert DeSalvo</td>
<td>253</td>
</tr>
<tr>
<td>14</td>
<td>Isopleth Map – Albert DeSalvo (Body Dump Sites)</td>
<td>254</td>
</tr>
<tr>
<td>15</td>
<td>Choropleth Map – Albert DeSalvo (Body Dump Sites)</td>
<td>255</td>
</tr>
<tr>
<td>16</td>
<td>Crime Site Point Pattern – Clifford Olson (Victim Encounter Sites)</td>
<td>258</td>
</tr>
<tr>
<td>17</td>
<td>Crime Site Point Pattern – Clifford Olson (Body Dump Sites)</td>
<td>259</td>
</tr>
<tr>
<td>18</td>
<td>Isopleth Map – Clifford Olson (Victim Encounter Sites)</td>
<td>260</td>
</tr>
<tr>
<td>19</td>
<td>Choropleth Map – Clifford Olson (Victim Encounter Sites)</td>
<td>261</td>
</tr>
<tr>
<td></td>
<td>Title</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>20</td>
<td>Crime Site Point Pattern – Angelo Buono and Kenneth Bianchi</td>
<td>264</td>
</tr>
<tr>
<td>21</td>
<td>Isopleth Map – Angelo Buono and Kenneth Bianchi (All Sites)</td>
<td>265</td>
</tr>
<tr>
<td>22</td>
<td>Choropleth Map – Angelo Buono and Kenneth Bianchi (All Sites)</td>
<td>266</td>
</tr>
<tr>
<td>23</td>
<td>Crime Site Point Pattern – Peter Sutcliffe</td>
<td>269</td>
</tr>
<tr>
<td>24</td>
<td>Isopleth Map – Peter Sutcliffe (Body Dump Sites)</td>
<td>270</td>
</tr>
<tr>
<td>25</td>
<td>Choropleth Map – Peter Sutcliffe (Body Dump Sites)</td>
<td>271</td>
</tr>
<tr>
<td>26</td>
<td>Crime Site Point Pattern – Richard Ramirez</td>
<td>274</td>
</tr>
<tr>
<td>27</td>
<td>Isopleth Map – Richard Ramirez (Body Dump Sites)</td>
<td>275</td>
</tr>
<tr>
<td>28</td>
<td>Choropleth Map – Richard Ramirez (Body Dump Sites)</td>
<td>276</td>
</tr>
<tr>
<td>29</td>
<td>Crime Site Point Pattern – David Berkowitz</td>
<td>279</td>
</tr>
<tr>
<td>30</td>
<td>Isopleth Map – David Berkowitz (Body Dump Sites)</td>
<td>280</td>
</tr>
<tr>
<td>31</td>
<td>Choropleth Map – David Berkowitz (Body Dump Sites)</td>
<td>281</td>
</tr>
<tr>
<td>32</td>
<td>Crime Site Point Pattern – Jeffrey Dahmer</td>
<td>284</td>
</tr>
<tr>
<td>33</td>
<td>Isopleth Map – Jeffrey Dahmer (Victim Encounter Sites)</td>
<td>285</td>
</tr>
<tr>
<td>34</td>
<td>Choropleth Map – Jeffrey Dahmer (Victim Encounter Sites)</td>
<td>286</td>
</tr>
<tr>
<td>35</td>
<td>Crime Site Point Pattern – Joel Rifkin</td>
<td>288</td>
</tr>
<tr>
<td>36</td>
<td>Isopleth Map – Joel Rifkin (Body Dump Sites)</td>
<td>289</td>
</tr>
<tr>
<td>37</td>
<td>Choropleth Map – Joel Rifkin (Body Dump Sites)</td>
<td>290</td>
</tr>
<tr>
<td>38</td>
<td>Crime Site Point Pattern – John Collins</td>
<td>293</td>
</tr>
<tr>
<td>39</td>
<td>Isopleth Map – John Collins (All Sites)</td>
<td>294</td>
</tr>
<tr>
<td>40</td>
<td>Choropleth Map – John Collins (All Sites)</td>
<td>295</td>
</tr>
<tr>
<td>41</td>
<td>Crime Site Point Pattern – Aileen Wuornos</td>
<td>297</td>
</tr>
<tr>
<td>42</td>
<td>Isopleth Map – Aileen Wuornos (All Sites)</td>
<td>298</td>
</tr>
<tr>
<td>43</td>
<td>Choropleth Map – Aileen Wuornos (All Sites)</td>
<td>299</td>
</tr>
</tbody>
</table>
44 Crime Site Point Pattern – Ian Brady and Myra Hindley 302
45 Isopleth Map – Ian Brady and Myra Hindley (Victim Encounter Sites) 303
46 Choropleth Map – Ian Brady and Myra Hindley (Victim Encounter Sites) 304
47 Crime Site Point Pattern – Jerry Brudos 306
48 Isopleth Map – Jerry Brudos (All Sites) 307
49 Choropleth Map – Jerry Brudos (All Sites) 308
50 Serial Murder by Day of Week 328
51 Distance to Crime Site 329
52 CGT Score Distribution 345
53 CGT Model Learning Curve 347
54 Comparative Hit Percentage Distributions 350
55 Lorenz Curve 351
56 Crime Trip Distance Over Time (20 Km Range) 368
57 Crime Trip Distance Over Time (50 Km Range) 369
58 Crime Trip Distance Over Time (150 Km Range) 370
59 Mean Logarithm of Crime Trip Distance Over Time 373
60 Crime Trip Distance Mean Standard Deviation Over Time 377
## LIST OF EQUATIONS

<table>
<thead>
<tr>
<th>Equation</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>106</td>
</tr>
<tr>
<td>2</td>
<td>106</td>
</tr>
<tr>
<td>3</td>
<td>106</td>
</tr>
<tr>
<td>4</td>
<td>107</td>
</tr>
<tr>
<td>5</td>
<td>109</td>
</tr>
<tr>
<td>6</td>
<td>111</td>
</tr>
<tr>
<td>7</td>
<td>111</td>
</tr>
<tr>
<td>8</td>
<td>113</td>
</tr>
<tr>
<td>9</td>
<td>183</td>
</tr>
<tr>
<td>10</td>
<td>219</td>
</tr>
<tr>
<td>11</td>
<td>219</td>
</tr>
<tr>
<td>12</td>
<td>219</td>
</tr>
<tr>
<td>13</td>
<td>219</td>
</tr>
<tr>
<td>14</td>
<td>219</td>
</tr>
<tr>
<td>15</td>
<td>223</td>
</tr>
<tr>
<td>16</td>
<td>223</td>
</tr>
<tr>
<td>17</td>
<td>223</td>
</tr>
<tr>
<td>18</td>
<td>225</td>
</tr>
<tr>
<td>19</td>
<td>225</td>
</tr>
</tbody>
</table>
When the throat of Victorian prostitute Polly Nichols was slashed in Buck’s Row on Bank Holiday, August 31, 1888, serial murder became part of our cultural lexicon (Rumbelow, 1988). While Jack the Ripper was certainly not the first nor last of his type, the unsolved mystery of the Whitechapel murders still symbolizes our lack of understanding of such dangerous predators. Some narratives have even suggested that serial murder is the quintessential crime of a violent, post-modern society (Carputi, 1990; Richter, 1989; see Ellis, 1991; Kerr, 1992).

My own interest in this area stemmed from two sources. First, as a police officer for over 15 years, I have found that the reasons for most crimes, if seen from the perspective of the offender, are not difficult to understand. Serial murder, however, is on the extreme fringe of human behaviour, a ritual of violence that defies simple explanation. Comprehending these individuals and their actions, even if only in some small measure, was a daunting challenge.

Second, the characteristics of serial murder are such that study in this area represented an opportunity to practically apply some of the themes of environmental criminology, particularly those found in the works of Professors
Paul and Patricia Brantingham. This research was thus undertaken in an effort to integrate the academic with the practical, the scholastic with the professional. I hoped that by combining science and strategy, experiment and experience, something useful would be produced for the worlds of both the ivory tower and the street.
CHAPTER I

INTRODUCTION

“Interview the subjects, what they’ll tell you is, is the thing that was really appealing to them was the hunt, the hunt and trying to look for the vulnerable victim” (Supervisory Special Agent John Douglas, Federal Bureau of Investigation; Mind of a serial killer, 1992, p. 3).

This PhD dissertation is an analysis of the spatial patterns produced by the hunting behaviour and target locations of serial murderers. Hunting behaviour refers to the victim search and attack processes engaged in by an offender, while target locations are the various geographic sites connected to a crime series. For serial murder these include victim encounter, attack, murder, and body dump sites. The patterns and methods of serial killer hunting activity were analyzed from a geography of crime perspective.

This study had three specific purposes which were, in increasing order of importance: (1) to add to the knowledge of serial murder; (2) to examine the geography of serial murder at both macro and microlevels; and (3) to construct a method for determining the most probable area of offender residence from the
locations of the crimes. The dissertation research has subsequently led to the development of geographic profiling, an information management strategy for serial violent crime investigation.

Serial killers are rare, but when they do strike the public and the criminal justice system are both significantly affected. Beyond the violence and tragedy of the crimes, serial murder produces tremendous fear levels in the community, generates heavy pressures for investigating agencies, and demands significant resources from police, courts, and prisons. Most murders are solved because there is a connection between the killer and the victim. Such a nexus is lacking in cases of stranger violent crime and the investigation of such crimes may involve sifting through hundreds of suspects and thousands of tips. Consequently, police often suffer from problems of information overload. If we wish to enhance the investigative response to this type of extreme random violence it is important to expand our knowledge of serial killers and their behaviour.

This dissertation explores serial murder at both macro and microspatial levels. At the macrolevel, frequencies, rates per capita, and rates per all murder were analyzed to discern regional patterns. At the microlevel, type of crime site, size of search area, journey to crime distances, and hunting behaviour were
examined in order to better understand serial murder target patterns. Of particular importance at this stage of analysis was an understanding of how such patterns were influenced by offender activity space, hunting style, and victim backcloth.

Data were collected in two forms: (1) information about serial killers; and (2) information about selected sets of serial murders. Both data types help add to the knowledge of serial murder and the geography of crime. The serial murder information, a more comprehensive database formed from a subset of the serial killer data, helped provide the detail necessary for an analysis of the relationship between offender residence and crime site locations — the primary purpose of the dissertation.

By establishing patterns in serial murderer hunting activity it proved possible to outline, based on an analysis of the locations connected to the crimes, the most probable areas within which the killer resided. The model of crime site selection proposed by Brantingham and Brantingham (1981, 1984, chap. 12; see

---

1 Previous research has been conducted into the geography of other types of serial violent criminals, including serial rapists (Canter & Larkin, 1993; LeBeau, 1987a, 1987b, 1992; Warren, Reboussin, & Hazelwood, 1995), and serial arsonists (Icove & Crisman, 1975). There are similarities in the spatial behaviour of many serial offenders suggesting the applicability of these findings to other criminal populations.
also Felson, 1986) was used as a heuristic device for conceptualizing the relationship between crime locations and offender residence. This led to a computerized algorithmic system for predicting offender residence from crime site geography.

The computerized system (the criminal geographic targeting model) compares the position of every point in the offender’s hunting area to the locations of the crimes and, through the use of a distance-decay function, produces a three-dimensional probability surface. The height of the surface at any given point represents the relative likelihood that the killer resides at that location. Specific investigative responses can be developed through overlaying this probability surface on a street map of the offender’s hunting area.

Increased knowledge of the spatial behaviour of serial killers can assist in the investigation of their murders in a variety of ways. Police strategies resulting from a geographic profile have included: (1) prioritization of suspects by area for investigative follow-up; (2) augmentation of psychological profiles with information on offender movement; (3) geographic deployment of directed patrol efforts; and (4) searches of computer databases by address or postal/zip code.

The knowledge gained through research of how and where this particular type of criminal predator hunts for victims has both practical and theoretical
implications. Geographic profiling is now an investigative support service offered by the Vancouver Police Department to law enforcement agencies in cases of serious violent crime. It has been used in several cases of serial murder, rape, and arson by police departments across North America and Europe.
CHAPTER II

SERIAL MURDER

The Phenomenon of Serial Murder

Serial murder is a frightening and perplexing phenomenon that has proven to be a difficult puzzle for both criminal investigators and criminological researchers. Despite being a rare event, serial murder has a broad-based impact on the larger community (Jenkins, 1992a, chap. 3; Silverman & Kennedy, 1993, p. 129). Fear, shock, repugnance, scientific curiosity, and morbid fascination are all common reactions to cases of serial killing (see Dietz, 1995). There are also growing concerns about the possible increase in the prevalence of this particularly violent predatory form of crime.

As serial murder is a label that means different things to different people it is important to define what is meant by this classification, and equally important to remember that the term should not be hypostatized.² To do so is to run the risk of lumping a diverse group of offenders into a single synthetic category. As Clifford

² There are conflicting versions of the term’s origination (see Canter, 1994, p. 290; also Ressler & Shachtman, 1992, pp. 29-30).
Robert Olson, Canada’s most infamous serial murderer, aptly puts it: “We can’t look into other serial killers minds as to what they do unless they allow to give there thoughts and views, You dont find many that have done this any place” (uncorrected personal communication, September 10, 1991). The thoughts of interviewed serial killers show just as many differences as they do commonalities.

Murder, abhorrent as it may be, is still possible to understand. Feelings of anger, betrayal, and frustration, motives of revenge, money, and expediency, assaults that cross that thin line between injury and death – all these are within the scope of imagination of most people. Indeed, it has been said that almost anyone is a potential murderer. Multiple homicide, however, is what the ghost of Hamlet’s father described as “foul and most unnatural murder,” and mass and serial killings are thankfully far beyond the ken of the vast majority of the members of our community. Unfortunately, this strangeness does not facilitate the efforts to explain, predict, and prevent.
Incidence and Population Estimates

Though statistically rare, serial murder has an incredible impact on communities that extends far beyond the range of the immediate victims and their families. Changes in single indices of crime seriousness (weighted measures designed to assess the relative seriousness of criminal offences) can be almost completely accounted for by shifts in homicide rates, despite the fact that over 90% of all major crime is property related (Epperlein & Nienstedt, 1989, pp. 352-354). Additionally, risk of victimization and fear of crime are not spread uniformly throughout society, but are instead influenced by many factors including sex, age, race, income level, and geography (Coburn, 1988, pp. 107-108, 123-124; Fattah, 1987, pp. 308-310; Langan & Innes, 1985; Lea & Young, 1984; Rose &

3 All forms of homicide are uncommon (Boyd, 1988, pp. 4-6; Skogan & Antunes, 1979, p. 221), and at least one Canadian study found that only 16% of murders involved more than a single victim (Canadian Centre for Justice Statistics, 1982, p. 2). This percentage would have been higher if the research had analyzed the number of victims as opposed to the number of cases. Silverman and Kennedy (1993, pp. 132-134) located 359 victims in 72 cases (from approximately 12,000 incidents) of Canadian mass murder, but note that Canadian homicide data cannot identify victims of serial killers. Reed and Gaucher (1976) comment that “the amount of repetitive killing in Canada is miniscule and certainly far less than appears to be generally believed” (p. 1). It should also be remembered that most killings involve intimates, as opposed to strangers (Boyd, 1988; Fattah, 1991, pp. 160-161; Silverman & Kennedy, 1993, p. 15, chap. 4).

With its serious consequences, long-lasting community impact, and political reverberations, serial murder invokes close scrutiny. Estimates of the incidence of serial murder and of the size of the serial killer population, however, are often inflated, inaccurate, and varied, with unarticulated methodologies, inadequate data sources, and haphazard estimation techniques (see Jenkins, 1994, chaps. 2-3). By its very nature, serial killing is a major news item, and often, for the area or group under attack, a political rallying point.4 Both Kiger (1990) and Jenkins (1992a, chap. 3) provide insightful discussions of the role of hysteria, inflated researcher claims, and the impact of the media in the construction of social problems surrounding serial murder.

Statistical analyses of the incidence and increase of serial murder have been attempted but definitional difficulties compound the problem (see below). Other issues affecting research efforts include linkage and communication problems, and

4 For example, see Rumbelow (1988, chaps. 4-5) for the response of the lower class to the Whitechapel murders of Jack the Ripper in 1888.
variations in social and historical context, police and investigative response, and official record keeping practice. By definition, a serial murder must be committed by a serial murderer, but determining just exactly what a serial murderer is, and who should be included under such a rubric for any given time period, is problematic (see Ball & Curry, 1995, pp. 225-227).

Assume for the sake of argument that the unapprehended Seattle-area Green River Killer has gone into retirement, never to kill again (see Smith & Guillen, 1991). Would he still be counted in an estimate of the serial murderer population? Should a potential serial killer, apprehended by the police after only a single homicide and subsequently incapacitated in prison, be included in such estimates (Bishop, 1946, pp. 22, 70; Boyd, 1988, pp. 255-258)? Being a serial murderer is assumed to be a status capable, at least theoretically, of being captured in a count done at a single point in time. This is a problematic and possibly unwarranted assumption.

Linkage problems can prevent many incidents of serial homicide from being recognized as such (Holmes & De Burger, 1988, p. 113; Norris, 1988, p. 76). Murders committed in different locations and separate police jurisdictions may not be seen to be part of a single series. Even those killings that occur in the same city...
may not be connected if there is a high murder rate, an overworked homicide squad, or the deaths are spread out over time.

The only official records in such cases may be missing person reports. Without a body, it is doubtful that a homicide statistic will ever be recorded. Many serial killers, including Jeffrey Dahmer, John Wayne Gacy, Jr., and Juan Vallejo Corona, buried or hid the bodies of their victims. Several of the groups at high risk – prostitutes, the itinerant, the destitute – may go missing without that fact being noticed by anyone. And with no complaint there will be no official missing person report.

Despite these difficulties, several researchers have attempted to estimate the prevalence and extent of serial homicide (Cavanagh, 1993). Leyton (1986, p. 2) states that there may be up to 100 of these murderers operating in the United States, responsible for the deaths of thousands of people. He expresses some surprise at this relatively low number considering the present violent state of society. Holmes and De Burger (1988, p. 19), however, estimate that there are currently 350 serial killers in the United States alone, responsible for between 3,500 and 5,000 deaths annually. Norris (1988, p. 252) claims to have researched 260 serial murderers, responsible for 10,360 victims, though he does not provide a
list of who these killers are. This equates to a seemingly high average of 40 victims per murderer.

Jenkins (1989, p. 377) found several hundred serial murder cases, 49 of which involved 10 or more victims, recorded in the newspaper archives since 1971. The U.S. Justice Department has conservatively estimated that there are 35 serial killers presently operating in the United States (Levin & Fox, 1985, p. 19), though the methodology used to come to this conclusion has never been published. Jenkins suggests that there are approximately 400 victims of serial murder per year, while Fox and Levin (1995a) have calculated that fewer than 240 people fall prey to serial killers annually in the United States. Hickey (1991, pp. 74-77) found, for the peak period of 1975 to 1988, only 4.21 reported new cases (29 to 42 victims) per year.\(^5\) The Federal Bureau of Investigation Behavioral Science Unit

\(^5\) The U.S. Justice Department's estimates are for active murderers, while Hickey's are for new cases. These figures do not appear that dissimilar when it is realized that the median number of years of homicidal activity for the serial killers in Hickey's (1991, pp. 74-75) sample was 4.3 years. Jenkins (1988b, p. 9) estimates a career length of just under 4 years for serial murderers in England.
(BSU)\(^6\) has stated that they receive approximately 30 requests annually for assistance in serial murder cases (Hagmaier, 1990).

Kiger (1990, pp. 36-47) critically evaluates the various methods used to estimate the incidence of serial murder, and describes the problems of unexplained methodologies and calculation procedures. In the United States, the current Federal Bureau of Investigation (FBI) Uniform Crime Reports (UCR) system does not allow the tracking of single offenders. And Supplemental Homicide Report (SHR) incident-based data, which often suffer from missing information, only allow counts of mass, not serial murder (Kiger, pp. 39-40).

Some researchers have used the sharp rise in the number of stranger and unknown motive homicide categories in the SHR as the basis for their estimates of the increase in serial murder. At best this is a tenuous extrapolation. An increase in felony murders (particularly those that are drug related and difficult to solve), expanded urbanization, and growing demands on police departments could all affect such rates (see Cardarelli & Cavanagh, 1992). Both Jenkins (1988a, pp. 4-5, 1994, pp. 68-70) and Kiger (1990, pp. 38-42) criticize the manner in which some researchers have used these data to estimate the occurrence of serial murder.

---

\(^6\) The Behavioral Science Unit is now called the Investigative Support Unit (ISU). This dissertation uses both terms, depending on the reference date.
The National Center for Health Statistics (NCHS) Division of Health Statistics gathers mortality data that have been used to check UCR homicide data. This information is not particularly useful for estimates of serial murder, but Kiger (1990, pp. 43-44) notes that coroner data on the number of unidentified bodies found each year, while not completely congruent, could be relevant. The FBI National Crime Information Center (NCIC) keeps a computerized record of such bodies. It also lists missing persons as does the Canadian Police Information Centre (CPIC) operated by the Royal Canadian Mounted Police (RCMP). This is another method commonly used for calculating the number of serial murder victims, particularly the number of child victims. The problem is in estimating the percentage of missing persons cases that result from serial killers who successfully dispose of their victims' bodies.

The number of children who go missing for reasons not related to parental abductions is relatively small. In contrast to inflated and inflammatory statements made by some special interest organizations, Kiger (1990, p. 45) estimates that somewhere between 20 to 300 children in the United States are murdered by strangers annually (see also Allen-Hagen, 1989; Finkelhor, Hotaling, & Sedlak, 1990). Between 1984 and 1988, only 3% of the 16,511 cases of missing and murdered children reported to the U.S. National Center for Missing and Exploited Children were abducted by strangers (Hickey, 1990, pp. 90-91). Of these 495
children, 15% (75) were found dead, and 47% (235) are still missing. Presumably, some unknown fraction of these murders were committed by serial offenders.

Cavanagh (1993) proposes a possible method for estimating the number of serial murder victims from official sources. For the period from 1976 to 1989, he aggregated SHR data from census subregions into 45 records (9 subregions by 5 time periods). Different types of homicide that might reasonably be related to serial murder were then totalled for each of these records, and using regression analysis, the type combinations which acted as the best predictors were determined. These homicide types included stranger or unknown, bodily contact, felony, and sexual murders. The model was calibrated against recorded counts of serial murder victims collected by Newton (1990a, 1990b).

Cavanagh (1993) cautions that his model is a preliminary exploration, and notes weaknesses in Newton’s enumeration that could bias the results. Nevertheless, he has developed a feasible approach, with an articulated methodology, for estimating rates of serial murder from SHR and census data. This is a significant improvement over inflammatory estimates and impressionistic guesswork.
The Increase of Serial Murder

While serial murder is not a problem unique to the latter half of the twentieth century, most researchers agree that the number of such killings are increasing (Hickey, 1991, pp. 74-77; Holmes & De Burger, 1988, pp. 16-21; Levin & Fox, 1985, pp. 19-26; Leyton, 1986, p. 2; Newton, 1992, pp. 1-6; Norris, 1988, pp. 47-57; Ressler, Burgess, & Douglas, 1988, pp. 1-3; see also Boyd, 1988, pp. 46-56). This belief appears to be based on both impressions and research.

Based on a comprehensive study of 203 offenders, Hickey (1991, pp. 76-77) found a ten-fold increase in the number of serial killers active in a given year in the period from 1970 to 1988, as compared to the period from 1795 to 1969. He also notes that the number of victims per case has dropped, probably due to increased police efficiency (see also James, 1991, p. 324). Since 1925 this figure has been in the range of 7 to 13 total murders per case. Jenkins (1988b, p. 9) estimates that 5 to 6 is a likely annual total of victims for recent American serial murderers, and 4 for English serial killers. Fox and Levin (1995a) suggest that

7 Hickey's figures are not adjusted for population growth. A temporal bias also exists in the accuracy of this estimate as the more recent a case, the greater the probability it will be located by a researcher in newspaper files or in other written works.
While 6 victims per year is typical, the figure should actually be doubled (to 12) to account for unknown victims.

Jenkins (1989) states that “serial homicide was a common experience in the early years of this century, little less frequent than in recent years” (p. 378). He provides tables of “Extreme Serial Murder Cases in the U.S.A. 1900-1940,” and “Serial Murder Cases 1971-1980, 1981-1988,” where 10 or more victims were killed (pp. 380, 390-391). Jenkins (1992b) does, however, find evidence of a “serial murder wave,” particularly involving lust killings, occurring in the United States from 1940 to 1990. From 1950 to 1964 he found 11 cases of lust murder, from 1965 to 1969, 11 cases, and in 1973, 12 cases. Recognizing that the actual scale of the problem may have been blown out of proportion to benefit certain ideologies or interest groups, he still reaches the conclusion that “there simply were more serial killers, more of whom could be categorized as lust murderers. A new problem was identified because a new problem had come into being” (p. 13).

Hickey names 24 murderers operating over a 40 year period, while Jenkins lists 49 murderers active in an 18 year period. This would appear to be a four-fold increase in total numbers from the first part of this century. Though Jenkins does not discuss the point, population growth in the United States since the turn of the century would affect the relative per capita serial killer figures. He also found
historical evidence of serial murder in both England (1988b, p. 4) and Germany (1988a, p. 6).

Several problems exist with historical research into the incidence of serial murder. In addition to the hurdles likely to be encountered in any attempt to locate data sources from years ago, and the problem of less than rigorous past practices in official record keeping, many cases of serial killings probably went undetected by the police. Itinerant murderers would have been able to travel and kill much more freely in the days before telecommunication. Early mass and serial murderers may have been characterized as demons, witches, or werewolves (Hickey, 1991, chap. 2) rather than as criminal offenders. Violence and murder were much more common in Europe during the medieval period than today (Brantingham, 1987, pp. 45-49; Brantingham & Brantingham, 1984, pp. 162-172; Wilson, 1984; see also Goodman & Waddell, 1987; Gurr, 1989a; Johnson, 1988). Conversely, in rural or village settings, offenders were likely apprehended much sooner than would be probable in large urban areas. Many potential serial murderers would thus have been caught and executed after their first victim.

Jenkins (1993b, pp. 471-473) also points out that a growth in the number of potential offenders does not necessarily follow from an increase in reported cases of serial murder. From the perspective of opportunity theory, he argues that the
construction of official records of serial killings is influenced just as much by victimological and bureaucratic factors as by the population of actual murderers:

Rather, the vital elements [in the production of “crime waves” of serial murder] may be the increasing opportunities to find vulnerable people to victimize, and the chance to escape apprehension after committing a murder. The opportunities might increase as a consequence of economic developments, or as a result of changes in mores, while bureaucratic and political factors might well affect the likelihood of detection. In either case, though, a murder “wave” could occur independently of the changing characteristics of the offender population. (p. 471)

The definitional and measurement issues involved make an assessment of the prevalence of serial murder very difficult, and it is not easy to predict what trends will take shape in the near future. The FBI suggests that the enhanced mobility of people in modern society, the increased content of violence in the mass media, a rise in the number of “easy” victims (in terms of target selection perceptions – a characteristic related to urbanization and social anonymity), the easy availability of pornography, and the growth in the level of illicit drug usage, are possible factors related to the increase in serial murder (Mathers, 1989; Ressler & Shachtman, 1992, pp. 133-134).

It is important to understand the level and seriousness of this crime without succumbing to unreasonable fear and unwarranted panics. Kiger (1990) puts the
problem in perspective when she refers to the dark figure of serial homicide and warns that “the incidence of serial murder in the United States is currently unknown, as is the prevalence of active offenders” (p. 47). The magnitude and the exact growth of serial homicide is not yet measurable with any degree of accuracy, and inflated estimates and contentious unfounded theories may create more problems than they solve (Kiger, pp. 35-36, 47-49).

Definitions and Typologies

“Patterns of murders committed by one person, in large numbers with no apparent rhyme, reason, or motivation” (title of hearings before the U.S. Senate, 98th Congress, on the issue of serial murder; Patterns of murders, 1983).

Defining serial murder is less than straightforward and attempts to distinguish and classify the phenomenon are not unambiguous. Generally, the label multiple murder\(^8\) is used to refer to mass, spree, and serial murders. The time interval between separate offences is the major variable most often used to distinguish these groupings (Holmes & De Burger, 1988, p. 16). Mass murder involves those

\(^8\) The term multicide is sometimes used to refer to those instances where the offender kills more than one victim (Dickson, 1958).
incidents where several victims are killed simultaneously, or within a relatively brief time period – a “sustained burst” (Leyton, 1986, p. 202). Holmes and De Burger (1988) define mass murder as “the slaying of several people, in the same general area, at roughly the same time, by a lone assailant” (p. 18).

Spree killings, an intermediate classification between mass and serial murder, involve those incidents where several victims, usually selected randomly, are killed over a relatively short period (hours to weeks) by a reckless, impulsive assailant (Holmes & De Burger, 1988, p. 18). The FBI define spree murders as those characterized by “killing at two or more locations with no emotional cooling-off period between murders. The killings are all the result of a single event, which can be of short or long duration” (Ressler et al., 1988, p. 139).

Definitions of serial murder are more problematic as the time periods involved are much greater. Levin and Fox define (1985) serial killers as “mass murderers who slay their victims on different occasions” (p. 13), a confusion in terminology that has been criticized by Hickey (1987) and others. Brooks, Devine, Green, Hart, and Moore (1987) provide the following definition of serial murder:
Serial murder is defined as a series of two or more murders, committed as separate events, usually, but not always, by one offender acting alone. The crimes may occur over a period of time ranging from hours to years. Quite often the motive is psychological, and the offender’s behavior and the physical evidence observed at the crime scenes will reflect sadistic, sexual overtones. (p. vii)

Norris (1988, p. 15) does not distinguish serial, stranger, motiveless, recreational, spree, and lust killers, though most other researchers separate these categories (Hazelwood & Douglas, 1980). Keeney and Heide (1994a, Table 1) review and criticize 10 different definitions for serial murder from the literature, and then suggest an eleventh, more inclusive, description. Perhaps the simplest and most functional definition is the one used by the FBI:

Serial murderers are involved in three or more separate events with an emotional cooling-off period between homicides. This type of killer usually premeditates his crimes, often fantasizing and planning the murder in every aspect, with the possible exception of the specific victim. Then, when the time is right for him and he has cooled off from his last homicide, he selects his next victim and proceeds with his plan. The cool-off period can be days, weeks, or months and is the main element that separates the serial killer from other multiple killers. (Ressler et al., 1988, p. 139)

---

9 The requirement of “one offender acting alone” is not a necessary or accurate component of a serial murder definition (see Footnote 10, below).
Holmes and De Burger (1988, pp. 18-19) list the central elements of serial murder as involving: (1) a pattern of repetitive homicide; (2) almost always one victim and one assailant per murder event;\(^{10}\) (3) the victim and the perpetrator are usually strangers or slight acquaintances; (4) the murders are psychogenic in origin; and (5) the lack of an obvious motive (though intrinsic motives, nonrational from the perspective of the outsider, may exist).

They divide serial murderers into four categories\(^{11}\) (one of which is broken down into three subcategories) according to motive, pattern of homicidal behaviour, and decision-making process (Holmes & De Burger, 1988, pp. 71-81; 

---

\(^{10}\) Neither of these conditions appear to be a central element of serial murder. There is no shortage of cases involving incidents of more than one victim per attack (Kenneth Bianchi, Edmund Kemper III, and Richard Ramirez, for example). And three separate studies have determined that multiple offenders are involved in at least one-fifth of serial murder cases: (1) 20% (Hickey, 1991, p. 81, chap. 8); (2) 21% (Jenkins, 1990, pp. 133-134); and (3) 25% (Simonetti, 1984, p. 11). These estimates suggest that over one-third of serial killers operate as teams or in groups (for example, 37% in Hickey’s study). Newton (1992, p. 50) found slightly lower figures; 87% of the American serial killers in his sample were “lone wolves.”

\(^{11}\) Holmes is currently researching a possible fifth serial murderer type, the predator (Robbins, 1991, p. 52). Characterized by an addiction to violence, these organized offenders are always on the hunt for prospective victims. They enjoy killing and appear to murder more often than other types of serial killers.
see also Holmes, 1989, pp. 70-73). Specific variables used in the discrimination included, amongst others, type of victim selection, choice of murder location, and method of killing.12 Unfortunately, Holmes and De Burger (pp. 22-23) do not actually apply this classification scheme to their database of 110 cases, or to their table of selected examples. Perhaps this is because the typology is not inclusive and the categories mutually exclusive. Their schema is as follows:

1. The *visionary motive serial murderer*, a relatively rare type with possible biogenetic origins, sees visions and hears messages that create a "rationale" for the killings.

2. The *mission-oriented motive serial murderer* believes that he or she has some task, such as the elimination of a certain "sinful" group (such as prostitutes) from society.

3. The *hedonistic motive serial murderer* achieves pleasure from the homicidal act. This category is further subdivided into *lust killers* (typically involving sexual sadism, anthropophagy, piquerism, and/or

12 Holmes and De Burger (1988, pp. 55-60, 72-73) based their classification on an analysis of 110 known serial murderers, listing common characteristics for various homicidal behaviour patterns. They used interview and biographical data, court transcripts, case studies, and clinical reports as their information sources.
necrophilia), thrill killers (who enjoy the “high” of murder), and comfort killers (who are oriented towards enjoying life, an endeavour often facilitated by the use of someone else’s money – this group includes the classic “black widow” murderers, one of the few types of female serial killer).

4. Finally, the power/control-oriented motive serial murderer seeks dominance over others. Control of the life or death of someone else is seen as the ultimate act of dominance.

Barrett (1991, pp. 149-165, 168) proposes a five category scheme for classifying serial murderers by motive, based on a cross between the Holmes and De Burger typology, and the FBI system for classifying serial rapists (Hazelwood, 1987, pp. 175-183): (1) the visionary serial killer; (2) the revenge serial killer; (3) the anger excitation serial killer; (4) the power assertive serial killer; and (5) the opportunist serial killer.

The visionary serial killer is the same as Holmes and De Burger’s murderer of the same name. The revenge serial killer, similar to the missionary-oriented murderer, seeks revenge for perceived wrongs suffered by themselves or society. The anger excitation serial killer is a combination of the hedonistic lust and hedonistic thrill killers. Concerned with the method, means, and excitement of
murder, this offender will often kidnap and transport victims to a secure location where they can be held and sadistically abused. The power assertive serial killer is equivalent to the power/control-oriented murderer. The opportunistic serial killer, one of the least predictable, murders either to facilitate escape from a crime (e.g., to eliminate witnesses), or as the most expeditious means to an end (e.g., to resolve a trivial argument).

Fox and Levin (1995a) also propose a modified Holmes and De Burger typology, with three categories, each with two subtypes: (1) thrill serial killers – (a) sexual sadism, (b) dominance; (2) mission serial killers – (a) reformist, (b) visionary; and (3) expedience serial killers – (a) profit, (b) protection. They note that most serial murders are thrill killings, particularly the lust type; the least common is the expedience serial killer. Rappaport (1988, pp. 42-47) divides serial killers into functionaries of organized crime groups, custodial poisoners and asphyxiators, psychotics, and sexual sadists. This grouping is somewhat confusing, however, as it is based on a mixture of method and cause.

Multiple murder definitions and taxonomies, like most classifications, are problematic. Categorical ambiguities concerning victim number and temporal

---

13 See Ball and Curry (1995) for a discussion of the logic, methods, and errors of definition within criminology.
spacing almost always exist with such definitions. Other types of multiple murder – the Nazi concentration camp massacres, political terrorism killings, and organized crime contract executions – cannot be accurately classified within these parameters (Levin & Fox, 1985, pp. 83-85; Leyton, 1986, p. 12; see Dillon, 1989).14

The recent increase in repetitive homicides in hospital and institutional settings would appear to be theoretically connected to serial murder (Leyton, 1986, p. 12), despite the differences in target geography. Victim selection and death sites are usually in the same geographic locale. Is the hospital murderer who commits a series of killings over the course of several weeks, and then moves on to repeat the sequence in another city, a serial, spree or mass murderer? Such events commonly lack many of the taxonomic features used in the typical classifications of multiple murder.

14 In Pennsylvania, there is a town square monument to Tom Quick, the celebrated Delaware “Indian Slayer,” who was responsible for 99 kills (Randall, 1988). Yet many of these deaths were, at least legally, murders, occurring after the signing of peace treaties. By some definitions, Tom Quick was a Colonial frontier hero; by others, he was the one of the earliest of America’s serial killers.
Cases of random, mass poisonings, such as the 1982 Tylenol tamperings in the Chicago area, also fail to fit neatly into the above categorizations (Levin & Fox, 1985, pp. 22-24). If several people die over an extended period of time and in different geographic locations as the result of a single episode of tampering, are they the victims of a mass or of a serial killer? It is obvious that taxonomies of multiple murder have grey areas and the categories should not be taken as all inclusive or mutually exclusive. While such typologies are problematic, they do have heuristic value for understanding the variations in serial murder behaviour. Some of the concepts in these taxonomies will be used in the microlevel analysis portion of this dissertation.

Theories of Serial Murder

“A mind full of fire, and a fist full of steel” (graffiti, Vancouver, British Columbia, April 1995).

While repetitive homicide is currently not fully understood, some efforts have been made to explore its aetiology. Such explanations run the gamut from the biological to the psychological to the sociological. Lunde (1976, p. 48), a psychiatrist with considerable clinical and courtroom experience in dealing with
murderers, states that almost all multiple killers are clinically insane white males. This insanity usually takes the form of paranoid schizophrenia or sexual sadism. While this may or may not be the case, Lunde goes little further in his analysis beyond suggesting the possible role of childhood experiences in the shaping of distorted world views commonly held by such offenders (pp. 48-49).

Brittain (1970), also a psychiatrist, observes that sadistic murderers can repeatedly kill when provoked in certain ways – usually by actions that cause a perceived loss of self-esteem. By replacing the term “serial murderer” with the labels “paranoid schizophrenic” and “sexual sadist” in their explanations, Lunde and Brittain make little real progress towards the understanding of the causes of this form of destructive behaviour. They also ignore the fact that most people in these groups never become murderers let alone repetitive killers.

15 Bartol and Bartol caution that it would be a mistake to “assume with Lunde that almost all mass murderers are mentally disordered in the clinical sense of that term.... they tend to be extremely introverted persons who perceive and think about the world in ways much different from our own” (1986, p. 185). This warning is borne out in the juristic arena of the courtroom where most serial killers are decreed legally sane (see also Ogle, Maier-Katkin, & Bernard, 1995). It is equally important to avoid the reification of insanity, a label that is more of a theoretical construct than a concept with demonstrable reliability and validity (Boyd, 1988, pp. 243-245, 280-281; Szasz, 1971).
Adopting a biosocial approach, Norris (1988) suggests that serial murderers suffer from a medical pathology. He feels that the causes of their violent actions lie in organic brain malfunctions which can lead to episodic and uncontrollable acts of violence:

Serial murderers share a significant number of common medical/psychological patterns that include evidence of possible genetic defect, soft and hard signs of brain damage resulting from injuries or other physical trauma, severe chemical imbalances brought about by chronic malnutrition and substance abuse, an absence of a sense of self which is the result of consistently negative parenting or nonparenting, and an almost hair-trigger violent response to external stimuli with no regard for the physical or social consequences. (p. 40)

The violent upbringing and negative parenting experienced by these offenders as children may have led to the reversal of the traditional dichotomies of reward and punishment, and love and hate, resulting in the development of what Norris (1988) calls a “nonpersonality type” that is incapable of controlling harmful impulses, or of functioning within the context of a normal social framework. He views serial murderers as having lost their free will, as actual victims of a form of contagious disease (pp. 39-40).

Serial killers, Norris (1988, chap. 2) believes, go through a ritual of murder, comprising seven key phases: (1) the aura phase, a withdrawal from reality; (2)
the trolling phase, the compulsive search and hunt for the next victim; (3) the wooing phase, in which the victim is conned into the killer’s trap; (4) the capture, the murderer’s penultimate moment; (5) the murder, in which the killer’s fantasies are ritually enacted; (6) the totem phase, involving the reliving of the crime through souvenirs in order to sustain the “high;” and (7) the depression phase, where the killer loses the power realized through the murder, setting off the whole process once again. It is not possible to assess Norris’ theories or conclusions as he does not describe his research methodology or present the data for the 260 serial killers he claims to have studied (Canter, 1994, pp. 206-207).

While biological and genetic theories of crime are not currently popular in criminology (Vold & Bernard, 1986, pp. 106-107; see also chap. 6), new research initiatives have been developed in the biosocial area (see, for example, Fishbein, Lozovksy, & Jaffe, 1989). The temptation to explain complicated patterns of human behaviour, especially when that behaviour is violent, frightening, and alien – as in acts of serial murder – in a “simple” manner, is very strong (see Boyanowsky, 1990). Such theories are comforting, despite their inadequacies, as they physically, congenitally, and otherwise totally separate the rest of us from the “monsters” in our society. Our culture, and therefore us as individuals, can then avoid all responsibility for these savage crimes.
Norris is not alone in his biological approach to the study of serial murder. Lange and DeWitt, Jr. (1990) state that there is evidence many serial killers appear to have suffered from a head injury or physical brain pathology. Their research examined 165 motiveless murderers, from 1600 to the present, representing all parts of the world. Neurological malfunctions, caused by head injuries, epilepsy, or other forms of subtle deep temporal lobe spiking, generates inter-ictal or post-ictal seizures that can lead to irresistibly compulsive autonomic or “automatic” behaviour. Their hypothesis is that serial murderers become victims of uncontrollable brain activity that leads to “fits” or “dazes” within which the killings occur. And in an untested theory, Peters (1990) suggests that infants who somehow suffer from periods of inadequate oxygen supply fail to develop proper social “consciences” and may develop into these types of murderers.

It is often difficult to obtain the data necessary to test criminological hypotheses at the biological level. Such explanations also suffer from an inability to explain historical and geographic differences in criminal activity. At best, biological theories must be integrated with socio-psychological or sociological theories to address the cultural dissimilarities found in crime, murder, and multiple murder (Ressler et al., 1988, p. 216).
Holmes and De Burger (1988, p. 70) employ a socio-psychological approach to understanding serial murder. They suggest that repetitive homicidal behaviour patterns are generated from a mind-set with the following critical features:

(1) an intrinsic and persistent motivation to kill;

(2) an expressive orientation to murder reinforced by the ability to psychologically “gain” from such violent acts (often linked to consistent fantasies); and

(3) central sociopathic features (absence of guilt, warped notions of love, capacity for extreme but casual and emotionless aggression, impulsivity, uncontrolled desires, asocial perspectives).

Holmes and De Burger (1988) warn that serial killers are not a homogeneous group, either in their actions or biographies. They therefore eschew a single causative theory, suggesting instead that if the proper conditions and dominant motives develop in conjunction with a certain mind-set, repetitive homicidal behaviour could result. Such a structure is seen to be (usually) necessary, but not in itself sufficient. They do not explain, however, what they consider such conditions and motives to be, or how such a mind-set comes about.
The sources of the repetitive homicide pattern are thus seen as psychogenic – the killer’s psyche is characterized by values, norms, beliefs, perceptions, and propensities that facilitate and legitimate multiple acts of murder. The locus of motives is thus intrinsic, but while the reasons for killing are judged to be aberrant, they are not the result of psychopathology or organic brain disease. Sociogenic factors, while not a direct cause, are important for understanding the context within which the propensities for murder develop. Holmes and De Burger’s comments should be seen more as a set of descriptive propositions rather than as a comprehensive theory.

Ressler et al. (1988, pp. x-xiii, 163) used the results obtained from the interviews of 36 convicted and incarcerated male sexual murderers (29 of whom had killed more than one person), in addition to various psychiatric, police, court, and prison archival data sources, to analyze motives and patterns of violent criminal behaviour. They construct a motivational model for sexual homicide that integrates the offender’s social environment, key childhood and adolescent formative events, subsequent patterned responses to these events, resultant actions
towards others, and the reaction of the murderer, via a mental "feedback filter," to his violent acts (p. 69, see generally chap. 6).16

Stage one of the motivational model describes the existence of an ineffective social environment for the murderer during childhood (Ressler et al., 1988, p. 70). His caretakers tend to ignore his behaviour, support his distortions of events, and generally act in a nonintervening and nonprotective manner. Life attachments and bonding forces are thus inadequately developed. Stage two of the model explains the critical importance of such formative events as sexual and physical abuse, developmental failure through negative social attachment leading to a diminished emotional response, and interpersonal failure caused by inconsistent parenting and deviant role models.

Stage three involves the patterned responses to these early influences. Rather than learning positive critical personal traits, the interviewed murderers in this study developed fetishes, preferences for autoerotic activities, feelings of entitlement, and characteristics of social isolation, rebelliousness, aggression, and

---

16 Ressler, Burgess, and Douglas (1988) note that their motivational model only focuses on cognitive and psychosocial factors, and does not deal with neurobiological and genetic influences that "may be present under certain conditions" (p. 69). They do not state what those conditions may be.
deceit. The resultant cognitive mapping and processing is structured through daydreams, fantasies, visual thoughts, and nightmares. Their internal dialogues involve absolutes, generalizations, and strong, limiting presuppositions. The themes of their fantasies tend to involve dominance, power, control, violence, sadism, masochism, revenge, torture, mutilation, rape, and death (see Dietz, Hazelwood, & Warren, 1990). They require high levels of kinesthetic stimulation and aggressive experience for sexual arousal.

The cognitive structure of the murderer during childhood eventually influences his or her behaviour. Stage four describes the external actions demonstrated by the offender during periods of childhood, adolescence, and adulthood. Typical behaviour patterns of the sexual murderer as a child involve cruelty to both animals and other children, disregard for others, firesetting, theft, mischief, and joyless, hostile, aggressive, repetitive play patterns. Adolescent and

17 There are similarities between some of these actions and the set of childhood characteristics termed the "Macdonald triad," often associated with future violent behaviour: torture of small animals, firesetting, and enuresis (Macdonald, 1961, 1963; for further discussion, see Levin & Fox, 1985, pp. 27-29). David Berkowitz was responsible for numerous arsons and suspected of several dog killings prior to, and during, his murder spree. He kept yearly journals with detailed records of 1,411 fires – locations, dates, times, fireboxes, etc. (Ressler & Shachtman, 1992, pp. 70-71; Terry, 1989, pp. 269, 295; Time-Life, 1992b, pp. 159, 161).
adult criminal actions may include assaults, break and enters, arsons, abductions, rape, nonsexual murder, and sex-oriented murder, often involving rape, torture, mutilation, and/or necrophilia. It is significant to note that many serial killers commit their first murder during their early or mid-adolescence years.18

Finally, stage five is a feedback filter process that serves as a justification system for the violent acts of such offenders. By reacting to and evaluating earlier antisocial behaviours the sexual murderer in effect learns more “efficient” patterns of operation. Errors are eliminated, methods of avoiding detection and punishment are improved, new means to increase control, dominance, and power are discovered, and enhanced states of arousal are learned. Fantasies become more sophisticated and refined during this period and the potential for increased violence and repetitive homicide lies in this stage of the model.

As superior as this research is in comparison to some of the previously examined works on serial murder, it is not without its methodological problems. Ressler et al. (1988) caution that their study group, “the largest compiled sample of

18 Henry Lee Lucas claims to have committed his first murder at either the age of 8 (Peters, 1990) or 14 (Egger, 1990, pp. 140, 154). The inconsistency is not due to source materials as both Peters and Egger personally interviewed Lucas (for a dissenting view on Lucas’s claims to homicidal fame, see Jenkins, 1988a, p. 2; Rosenbaum, 1990b).
sexual killers interviewed for research purposes" is not a representative random sample (pp. x-xi). The model has yet to be empirically tested, though a study of 62 serial murderers by Cleary and Luxenburg (1993) also found common background characteristics of abuse and broken homes.

There is also a failure by Ressler et al. (1988) to supply tests of statistical significance for the reported results. Furthermore, the lack of comparative background data for the general population does not allow their findings to be contextualized. For example, they state that 61% of the sexual murderers they interviewed admitted to having rape fantasies during childhood or adolescence. For this figure to have real meaning, it must be placed in some sort of context – what are the comparative responses to this same question from samples of the overall populations of noncriminal males, criminal offenders, sexual offenders, and nonsexual murderers? No control groups of any sort were used in their research.

Lange and DeWitt, Jr. (1990) state that the 36 sexual murderer sample used in this research was woefully inadequate for any extrapolation purposes, and the database so flawed that the U.S. Department of Justice cut off the project’s funding after an external review (see Nobile, 1989, p. 45). They also chastise the FBI for their uncritical acceptance of the statements of the interviewed killers (but see Ressler et al., 1988, chap. 11, for a partial discussion of this problem). They
underline their indictment with a quote from sex murderer Colin Pitchfork: “Probation officers and psychiatrists, these people are quite happy if you tell them what they want to hear.... I can’t believe how easy it is to spin yarns to these people.” Canter (1994, pp. 66-76; see also Copson, 1993, p. 6), while also skeptical of the FBI’s methodology, puts their approach in more balanced perspective.

Noting the frequency with which examples of dissociative processes can be found in the literature on serial murderers, Vetter (1990, pp. 79-84, 87-89) suggests that systematically administering Bernstein and Putnam’s Dissociative Experiences Scale (DES) to known serial killers might prove to be a fruitful avenue for new research. In his view, the behaviour of many such killers shows evidence of what he terms the Mephisto Syndrome, a combination of dissociation and psychopathy (see also Carlisle, 1993).

Dissociative disorders feature “a disruption in the usually integrated functions of consciousness, memory, identity, or perception of the environment” (American Psychiatric Association, 1994, p. 477). The disorders, as presently defined in the Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition) (DSM-IV), include dissociative amnesia, dissociative fugue (formerly psychogenic fugue), dissociative identity disorder (formerly multiple personality...
disorder), depersonalization disorder, and dissociative disorder not otherwise specified (American Psychiatric Association, pp. 477-491).

Thrill-seeking, pathological glibness, antisocial pursuit of power, and lack of guilt characterize the extreme “true” psychopath (Vetter, 1990, p. 81). The DSM-IV uses the term antisocial personality disorder (ASPD), rather than sociopath or psychopath (American Psychiatric Association, 1994, pp. 645-650). The ASPD diagnostic criteria in the DSM-IV have been significantly revised from those in the previous edition, DSM-III-R (American Psychiatric Association, 1987, pp. 342-346), as they had come under attack as being too broad and behaviour oriented (Hare, Hart, & Harpur, 1991).

These critiques led to the development of the Psychopathy Checklist – Revised (PCL-R) by Robert Hare. Based on the work of Cleckley (1982) and others, this instrument appears to more accurately measure psychopathy as a personality disorder (see Hare, 1993; Hare, Harpur, Hakstian, Forth, Hart, & Newman, 1990; Hare, McPherson, & Forth, 1988; Hart, Hare, & Harpur, 1992). Research on psychopathy with the PCL-R helped inform the development of the modified ASPD diagnostic criteria now used in the DSM-IV (Hare, Hart, & Harpur, 1991).
While it is often suggested that many serial murderers possess psychopathic personalities, the disorder is not in itself a sufficient condition for repetitive violence. Many psychopaths – no matter which definition is used – are not criminals let alone serial killers (Andrews & Bonta, 1994, pp. 217-220; Hare, 1993, pp. 86-87; Siegel, 1992, p. 176). And almost everyone experiences some type of dissociative event at one time or another. While Vetter's ideas may inspire future research, they are, as of yet, still untested.

Hickey (1991, chap. 4) assesses the possible application of a variety of stock criminological theories for the explanation of serial murder. He discusses a form of social structure theory (in this case, the relationship between urbanism and murder), social process theory (the learning of aggression), neutralization theory (the dehumanization of murder victims), Hirschi's (1969) control theory (weakened social bonds), and labelling theory (the formation of the killer's self-image).

He concludes: "Because research into serial murder is in its infancy, the haste to draw quick conclusions about its etiology is not only speculative but dangerous" (Hickey, 1991, p. 64). In particular, he questions certain beliefs concerning the influence of alcohol and pornography on the cause of serial murder (pp. 64-65).
Hickey (1991, pp. 65-73) proposes a tentative multiple factor model for the purposes of future research and discussion. His trauma-control model describes the processes and factors that may influence the early stages in the development of a serial killer. A series of traumatic events (such as parental rejection, an unstable family life, or sexual abuse) lead to feelings of inadequacy and low self-esteem. As more trauma is suffered, increasingly violent fantasies start to develop: “The most critical factor common to serial killers is violent fantasy” (Hickey, 1991, p. 70). States of dissociation also may result as a means of psychological protection.

In the cases of some serial murderers, background factors and facilitators may be precursors to violence. These background factors may be biological, psychological, or sociological. Suggested examples of facilitators include the use of alcohol, drugs, or pornography. On their own, however, such background factors and facilitators are not sufficient conditions, as millions of people are constantly exposed to them without becoming killers.

Instead, such factors may act as catalysts for aggressive behaviour on the part of those who experience increasingly violent fantasies. If this process of trauma and fantasy continues it may eventually lead to an acting out of violent and murderous thoughts. When this develops into a cycle where the killing feeds back into the trauma and the fantasy life, repeated murders may result if the offender is
not caught. Whether Hickey's theory of serial killer development is valid remains to be empirically tested. It is very likely that any attempts at explanation will require the incorporation of several aetiological factors, and Hickey has stated that it is unlikely that multiple homicide can be attributed to any single cause. Available research suggests that violent sexual fantasies will likely be one of those causative factors.

Levin and Fox (1985, pp. 38-39) criticize the narrow theoretical focus on the offender in studies of multiple murder. They stress that while the role of biology and the effects of early experience cannot be ignored, "situational factors – experiences and learning beyond the fifth year of life ... are at least as critical in encouraging a murderous response from someone who may or may not be predisposed to violence" (p. 39). From a study of 42 mass and serial killers and FBI data on simultaneous homicides, they constructed profiles of the typical multiple murderer (pp. 47-64). Such killers are most often white males\(^{19}\) in their

\[\text{\^{19} Levin and Fox (1985, p. 510) note that while one-half of the single victim homicides in America involve black offenders, only 20% of the multiple murders in their study (U.S. cases from 1974 to 1979) had a black perpetrator – considerably closer to the 11.7% actual racial composition of blacks in the United States (Cleveland, 1985, p. 806). Hickey (1991, p. 77) estimated that 10% of the serial killers in his research (U.S. cases}\]
late twenties to early thirties. Rarely psychotic, they are usually more ordinary in background, appearance, and personality than anything else. The murderous act is usually precipitated by a period of frustration, and then triggered by some particular event.

Levin and Fox's (1985, p. 52) sample included only one female and they note that, according to FBI statistics, fewer than 7% of all simultaneous homicides involved female offenders. All 36 sexual murderers in the study by Ressler et al. (1988, p. x) were male, and at least one of the authors believes that there has never been a true female serial killer (Ressler, 1993; Ressler & Shachtman, 1992, p. 83; but see also Epstein, 1992). Hickey (1991, p. 107), however, found 17% of the serial murderers who operated in the United States between 1795 and 1988 to be female – similar to the percentage of female offenders found in single victim murders in that country (Holmes & De Burger, 1988, p. 15; Levin & Fox, p. 52). He also noted that females were involved in 38% of the team killer cases (p. 175). Newton (1992, p. 49) found that 10% of the serial murderers in his sample were female.

from 1795 to 1988) were black; since 1975, however, this figure has risen to 21%. Newton (1992) found 16% of the U.S. serial killers in his study were black.
Segrave (1992) discusses 83 female serial and mass killers from around the world who murdered from 1580 to 1990. She describes the typical female serial killer as having murdered 17 people over a 5 year period, most often by poison. These crimes usually took place within the home of either the offender, or less likely, the victim (though, in some cases, both may share a residence); the victim is almost never killed on the street or in a public place. The majority of victims, many of whom are from powerless groups, are related or possess other close ties to the killer (p. 1; see also Hickey, 1986; Scott, 1992, pp. 51-53).

In their study of solo female serial murderers, Keeney and Heide (1994c) found similar results including an almost complete lack of mobility; 13 of the 14 offenders were place-specific killers, their victims most often in custodial care (43%), or else family members (37%). They observed differences between these females and their male counterparts in terms of behaviour patterns, method of victim search and attack, use of torture, crime scene organization, motive, and psychiatric diagnosis, amongst others (see also Scott, 1992). They suggested that unique as well as common aetiological factors may be involved in cases of female serial murder.

Cameron and Frazer (1987) see social and political context as critically important in the understanding of repetitive sexual and lust murderers. They note
that feminists “locate male violence against women in the realm of the political ... a collective, culturally sanctioned misogyny which is important in maintaining the collective power of men” (p. 164). Caputi (1990) states that serial and sexual murder “are crimes of sexually political import ... a product of the dominant culture. It is the ultimate expression of a sexuality that defines sex as a form of dominion/power” (p. 2).

Cameron and Frazer suggest that the depersonalization of women and their social representation as objects facilitates male violence. Sex murder, an extreme form of such violence, can be viewed as a type of sexual terrorism, though they caution that this account of sex murder is not adequate in itself. However, they fail to address a central question of why some males — and females — repeatedly torture and kill innocent victims (both female and male, human and animal) while the vast majority of the members of society, subject to the same cultural images, never murder anyone during the entire course of their lives. While misogyny may play an important role in understanding certain types of serial and mass murder, and probably influences victim selection, it is not in itself sufficient explanation.

---

20 The victims of serial killers are more likely to be females than males. Hickey (1991, pp. 86-87) found 31% of serial murderers targeted only females, 21% only males,
Using a historical sociological perspective, Leyton (1986) characterizes serial murder as “a kind of sub-political and conservative protest which nets the killer a substantial social profit of revenge, celebrity, identity, and sexual relief.... a primitive rebellion against the social order” (p. 14). Seeking to achieve personal status and revenge for past denial, the repetitive killer strikes back at society. Consequently, different social orders produce different types of serial killers.

Noting the abnormal number of serial murders that occur in the United States as compared to other parts of the world, Leyton (1986, pp. 1-2, 312-322) lists several explanatory factors for the modern American phenomenon of serial murder. Mass murder occurring in other historical periods would have a distinct aetiology dependent primarily on class structure and relations.

and 48% both sexes. By comparison, only about one-quarter of all murder victims in the United States are female (Hickey, p. 84; Holmes & De Burger, 1988, p. 15).

While the United States might have more than its share of serial killers, there are several documented cases from other countries. Jenkins (1988b, 1994, pp. 42-44), for example, lists 12 English serial murder cases, involving at least 4 victims, from 1940 to 1985, and 7 German cases, involving at least 10 victims, from 1910 to 1950. The English total represents 1.7% of all known murders in England, a similar percentage to that found for serial killing within the United States (Fox & Levin, 1995a; Jenkins, 1988b, p. 7, 1994, p. 46). Pinto and Wilson (1990) list 17 cases of serial murder in Australia from 1900 to 1990 (14 since 1959).
He suggests that the increased experience in twentieth-century American culture of the incidence of family breakdown – caused by divorce, adoption, illegitimacy, and child institutionalization – occurring within the context of a stratified and class hierarchical society, has led to a growth in the number of people who feel a lack of social “place.” These people may consequently not develop a coherent socially constructed identity.

This lack of identity is agitated by the internal social crises created when culturally inculcated ambition is stifled, and by the closure of middle-class positions, the constriction of the extended family, the expansion of urbanization, greater geographic mobility, a rise in anonymity, the loss of community, the disintegration of the institutions of family, marriage and parenthood, and an increase in failure, alienation and despair amongst other such tensions currently operating in North American society. These tensions are most acute in the lower classes, their members the most threatened.

Leyton suggests that such factors can lead those of the upper working and lower middle classes to attack members of the class group that they perceive as excluding or oppressing them, in an effort to “level” society. These attacks occur in a social context significantly marked by the impact of a culture of violence. Modern American society condones revenge and links violence to lust and sex.
Consequently, such revenge or grudge murders engendered by failed ambitions are a path to “success,” to attention and celebrity.

Leyton’s theory, as intriguing as it may be, is based on very limited data and he makes no effort to test his conjectures empirically. He also groups all serial killers together, an approach that would appear to be both theoretically and methodologically wanting. Finally, the preponderance of data on serial murder victimology indicates that members of powerless groups are most at risk (see below).

Other researchers have presented a potpourri of theories to explain the genesis of serial, sexual, and sadistic murder: sexual repression and conflict (Heilbroner, 1993); maternal seductiveness and rejection coupled with the unavailability of the father (Revitch, 1965, p. 646); borderline personality organization and gender identity conflict (Rappaport, 1988, pp. 44-46); learning theory (Hale, 1993); antisocial personality disorder (Spore, 1994); dissociation and obsession (Carlisle, 1993); obsessive-compulsive disorder, organicity, and multiple personality disorder (Brown, 1991b; see also Reese, 1979); paraphilic sexual sadism (Drukteinis, 1992); the “Right Man” syndrome, a violent incapacity to be wrong (Wilson & Seaman, 1990, chap. 7); an ego-inflating self-conception and the exercise of one’s darkest desires through adventurous risk and sexual recreation.
(Green, 1993, chap. 9); Münchausen syndrome by proxy (Keeney & Heide, 1994c); and classical necrophilia and vampirism (Brown, 1991a).

While explanations for the origins of such extreme violent behaviour are many and varied, ranging from the bio-genetic to the socio-historical, very few of them are based on sound empirical research. Limited case studies, unrepresentative samples, problematic interviews, unspecified methodologies, untested classifications, and pure speculation characterize many of the discussions of serial murder. The lack of an empirically-based taxonomy also seems to plague most attempts at explanation. The very term “serial killer” is a hypostatized label, but work in the area of criminal behaviour profiling suggests the involvement of several different personality types in multiple murder, each with distinctive antecedents and violent behaviour triggers.

It is likely that the presence of several critical factors on various conceptual levels – biological, psychological, and sociological – is required to produce the conditions necessary for the creation of a multiple murderer.22 Such a development requires the overlapping causal influences to be positioned just so; if

22 See Boyanowsky (1990) for a discussion of the dangerousness associated with employing single factor theories.
anything is out of line then the path of development is blocked. Thus serial and multiple murderers are still rare in our society.

This lack of an accepted aetiological model for the development of the serial murderer’s motivation or propensity for extreme and overt random violence is not an impediment to understanding other elements of the crimes of serial killers. Searching for underlying patterns amongst the “randomness” of such crime series can lead to analyses that may be informative and telling.

**Victimology**

In cases a lot are just encountered by the serial killer who is hunting for the victim he needs: As for how are they stalked, approached, attacked, and trapped, each serial killers has his own personal mode and manner or form of current style and fashion ... the serial killer kills strangers 95 percent of the time because as the safest target in terms of avoiding detection.... Children: young boys and girls are frequently desirable victims by the serial killer for sex.... Most serial killers have selected there murder scenes by the place they take there victims to: as for the relevant geographice areas selected by the offender (serial killer) this dependes on the seasons, and were the serial killer is killing. (Clifford Olson’s uncorrected verbatim description of how serial murderers select their victims and crime sites; Olson, 1992b, pp. 6-8)
One of the purposes of victimology is to help explain the role of the victim in the occurrence of crime. It stresses the importance of dynamic behaviours, and environmental, situational, and triggering factors for an understanding of patterns of crime. "In the victimological perspective, violent behavior is viewed not as a unilateral action but as the outcome of dynamic process of interaction" (Fattah, 1991, p. xiv).

The chances of any given individual becoming a victim of serial murder is extremely low, on par with the odds of being struck by lightning. Most homicide victims are killed by intimates or associates and stranger murder is still rare (Silverman & Kennedy, 1993, pp. 97-104). Serial killers are believed to be responsible for 1% to 2% of all murders in the United States and England; such murder would then account for only 1 out of every 10,000 U.S. deaths (Fox & Levin, 1995a; Jenkins, 1988b, p. 7, 1994, p. 46). Hickey's (1991, p. 77) estimates are even lower. He found a total of 1,483 to 2,161 recorded serial killings in the United States from 1795 to 1988. Even for the peak period in his study (1975 to 1988, 411 to 592 victims), the annual risk rate was only about 1 in 7 million (pp. 75-77). Cavanagh (1993) calculated a significantly higher total of 1,424 U.S. serial murder victims for the period from 1976 to 1989. His figures are based on
Newton's (1990a, 1990b) collection of cases, which, he cautions, includes incidents that might not be considered as true serial murders by all researchers.

It is essential to recognize, however, that risk of crime is not spread uniformly throughout the population. Particular types of people, by virtue of their sex, age, race, occupation, or location, are at much higher risk of victimization (see, for example, Block, Felson, & Block, 1985). “Just as lions look for deer near their watering hole, criminal offenders disproportionately find victims in certain settings or high-risk occupations” (Felson, 1987, p. 914).

Keppel (1989, p. 63) lists six activities commonly engaged in by serial murder victims at the point of their initial approach: (1) sleeping at home; (2) looking for a job; (3) going to a tavern; (4) prostitution; (5) walking on a college campus; and (6) hitchhiking. Hickey (pp. 87-89) assessed victim facilitation as high in 16%, low in 72% to 75%, and mixed in 9% to 12% of serial murders.

Hickey (1991, pp. 86-87) also found that while some serial murderers attacked only females or only males, many would target either sex. Most victims were strangers, and though this percentage was on the increase, family members and acquaintances of the offenders were not immune (pp. 81-84). Two-thirds of serial murder victims were preyed upon by someone from their own community (pp. 78-81). In cases of mass murder, the victims are usually white, killed by a
handgun or rifle – suggesting a connection with the offender’s easy access to and/or prior experience with firearms (Levin & Fox, 1985, pp. 52-53, 58-59). In cases of serial murder, victims are usually strangled or beaten. All types of multiple murder appear to occur more frequently in urban areas.

It has been suggested that some serial murderers focus on children because they represent society’s future. In this manner, such offenders are extracting revenge from a society that they feel has wronged them. Adults, however, are the most common victims of serial killers (Hickey, 1991, pp. 85-86). The U.S. Office of Juvenile Justice and Delinquency Prevention (OJJDP) estimates that annually there are one to two stranger abductions per million population, with teenagers (14 to 17 years of age) at highest risk (Allen-Hagen, 1989; see also Lau, 1989). This figure did not seem to be on the increase. Serial murder cases involving children, as opposed to adults, as victims, are more likely to involve a family member or acquaintance as the offender (Hickey, pp. 83-84, 89-99).

The choice of victim may provide insights into the nature of the serial murderer. Detailed victim information is regarded as one of the key elements in the psychological profiling process (Douglas, Ressler, Burgess, & Hartman, 1986, pp. 406-407; Holmes, 1989). The victim is often symbolic and may remind the
killer of someone from the past.\textsuperscript{23} Particular victim appearances, specific actions, or the elicitation of certain responses, may trigger a murderous response from the offender. "The plan or fantasy constructed earlier [by the killer] may call for a victim who meets certain criteria, and many murderers have been known to seek out a victim who is exactly right for the fantasy" (Ressler et al., 1988, p. 50). In other words, the victim must fit the offender's fantasy. Several of the killers in their study admitted that they went hunting nightly for victims,\textsuperscript{24} though the proper circumstances for murder would only arise occasionally (p. 51).

Some serial murderers have very specific and well articulated victim criteria. Joel Rifkin, who strangled 17 street prostitutes, confessed to driving around for hours, circling the red-light strolls of Lower Manhattan in a search for just the right type of woman – petite, with straight dark hair and sexy jewelry (Pulitzer & Swirsky, 1994a, pp. 33, 42, 1994b, pp. 7-8). Before he would kill them they had to first accept money for sex, and then do something that angered him. According to the FBI, Robert Hansen, Alaska's worst serial killer, had three

\textsuperscript{23} A study of sexually sadistic criminals found only 17% (5) of the 30 cases involved a victim with an evident resemblance to someone of psychological significance in the offender's life (Dietz, Hazelwood, & Warren, 1990, p. 173).

\textsuperscript{24} See, for example, the discussion in Ressler and Shachtman (1992, pp. 68-69) of the hunting behaviour exhibited by the Son of Sam, David Berkowitz.
such requirements. They had to initially approach him for sex, then refuse to do a requested sexual act, and finally try to escape (Du Clos, 1993; Gilmour & Hale, 1991; Pulitzer & Swirsky, 1994b, p. 269).

Clifford Olson, by comparison, varied both the sex and the age of his victims (Ferry & Inwood, 1982; Mulgrew, 1990). He would pick up victims at bus stops, offering them jobs and enticing them into his car through beguilement and seduction (Worthington, 1993, pp. 53-54). Some he would drive home, some he would sexually assault, others he would murder. Olson himself does not seem to know why he killed those he did; on some occasions he has stated they were murdered so they would not report the assault to the police, and on others he has blamed his use of alcohol and pills.

Holmes (1989, pp. 70-73) suggests that, because of variations in offender motivation, victim selection may depend upon serial murder type. Nonspecific victim selection is a crime scene characteristic associated only with the visionary serial murder type, while known victims are associated with visionary and comfort serial killers, and relational victims are associated only with comfort serial murderers (Holmes, 1989, p. 71). Barrett (1990, p. 166) notes that, over time, serial killers become less selective, often constrained by victim availability.
In an excerpt from a lengthy and insightful interview with a convicted serial murderer, Holmes (1989) presents an offender’s perspective on the issue of victim selection:

Among the issues I have heard discussed regarding serial killers is that of their victim-selection process. The traditional school of thought has it that serial murderers, on the whole, select their victims on the basis of certain physical and/or personal characteristics which they, the victims, possess. This assertion presupposes that, within the mind of each individual serial killer, there evolves a synthesis of preferred characteristics and, ultimately, a clear, specific picture of his ideal victim – male or female, black or white, young or old, short or tall, large-busted or small, shy or forward, and so on. Then, as the reasoning goes, when a typical serial killer begins an active search for human prey, he will go to great lengths to capture and victimize only those individuals who closely fit the mold of his preferred “ideal.”

I am personally convinced that every serial killer does indeed nurture a rather clear mental picture of his own ideal victim.... Notwithstanding this point, however, I strongly believe that in the case of most serial killers, the physical and personal characteristics of those on their respective list of victims only infrequently coincide with the desired traits of their imagined “ideal”....

There are two basic, interrelated reasons for this disparity. The first centers upon the extreme caution exercised by a serial killer in his predatory search for a victim; the second, upon the nature of the compulsion that drives him to violence.... This unremitting sense of caution has direct ramification on victim selection in that, during the course of his
search for human prey, a serial killer is seldom apt to find his preferred ideal victim in a position of safe and easy capture. In truth, it is a difficult and time-consuming task to locate any potential victim who can be readily seized without risk of detection.... A serial killer could, of course, bide his time. He could reject all other easy prey until, at last, his ideal victim appeared in circumstances perfectly suited to his caution. In actual practice, however, he rarely will choose to wait very long.

Why is this so? Because as the second reason given earlier, the nature of a serial murderer’s compulsion for violence is such that it precludes any prolonged or self-imposed delay in acting out his brutal urges. Initially, he may have set out fully determined to succeed at capturing his ideal victim regardless of how long he might have to remain on the prowl. But, as time passes without his promptly accomplishing this specific end – a common occurrence within his many hunts – his ballooning compulsion for violence itself will swiftly overtake any initially-held obsession for a particular mold of victim.... [and] his intense and mounting hunger for real life violence against a real life captive inevitably compels him to settle for any soonest-available victim of opportunity. (pp. 61-63)

As suggested by this serial murderer, target choice is not just determined by offender fantasy and psychological pathology; it is also influenced by such factors as victim availability and attack opportunity (Jenkins, 1993b). By definition, a serial killer must have been responsible for at least three separate acts of homicide, and to achieve this status an offender needs to be able to escape apprehension.
Consequently, murderers who prey on “easy victims,” those whose actions and lifestyle facilitate attack, and whose social marginalization diminish public reaction and official response, are more likely to be successful repeatedly (Cleary, Klein, & Luxenburg, 1994). Opportunity is thus important in understanding and explaining patterns of victimization. “Fashions in multiple homicide appear to change over time in ways that reflect changes in potential victim populations.... Victimological factors can ... [also] go far toward accounting for distribution by place and region” (Jenkins, pp. 471-472).

In addition to those actually murdered by serial killers, there are a host of secondary victims who suffer from the crimes of such offenders (Fox & Levin, 1995b; Holmes & De Burger, 1988; Ressler et al., 1988, chap. 13). The family and friends of the murder victim experience the grief, loss, and financial strain associated with the murder of a loved one. These individuals are often subjected to “repeat victimization” by the press, the police, and the courts. And while treatment programs are available for offenders, there are often no provisions for psychological counselling services for the victims’ families. In response, self-help groups and advocacy agencies such as Parents of Murdered Children, the Adam Walsh Child Resource Center, and Victims of Violence International have been formed (Sullivan, 1995).
Society is also victimized through the resulting fear and suspicion (Fowler, 1990, pp. 8-9). Increased mistrust of strangers, fear of public spaces, and reluctance to help others all contribute towards a breakdown of community. Additionally, economic costs associated with cases of serial murder are usually high; investigation expenditures, court costs and legal fees, and long-term incarceration expenses can add up to millions of dollars (Victims of Violence Society, 1990, p. 43). The psychological and fiscal impact of serial murder spreads far beyond the small number of actual homicide victims.

Serial Murder Investigation

Investigative Difficulties

The nature of serial murder creates unique problems for law enforcement, requiring special police responses and investigative strategies. It has been suggested that there are only three ways to solve a crime: (1) a confession; (2) a witness; or (3) physical evidence (Klockars, 1983, pp. 134-135; Simon, 1991, pp. 73-77). Traditionally, the search for witnesses, suspects, and evidence has followed a path moving outwards from the victim and crime scene. Most homicides are cleared for the simple reason that they involve people who know
each other, and the process of offender identification is often only one of suspect elimination.

Such obvious connections rarely exist in cases of serial murder. The lack of a relationship between the victims and the offender make these crimes difficult to solve (Skogan & Antunes, 1979, p. 219). Working outwards from the victim during the investigation of stranger homicides is a difficult task. The alternative, then, is to work inwards, trying to establish some type of link between potential suspects and the victim or crime scene.

This process requires the determination and delineation of a likely group of potential suspects, a process referred to by Kind (1987b, pp. 24-25) as “framing,” and by Skogan and Antunes (1979, p. 221) as establishing the “circle of investigation.” Such an effort typically involves the inspection of those parties with relevant criminal or psychiatric records, the accumulation of intelligence, and the collection of suspect tips from members of the public. While information is an

25 Boyd (1988, p. 127) found that 80% of convicted murderers in Canada had killed either family members or acquaintances, while Silverman and Kennedy (1993, p. 15) determined that 8% of Canadian murders from 1961 to 1990 involved strangers, and 14% occurred during the commission of another crime. The arrest of the offender – a prerequisite for conviction – is more likely to occur, however, in those cases where a close relationship exists between the killer and the victim.
important determinant of the likelihood that the police will solve a crime, it must be of a useful nature (Kind, 1987b, chap. 4; Lyman, 1993, chap. 7; Skogan & Antunes, pp. 219, 235). The determination of what is useful, and what is not, is a less than straightforward task. Because these investigative efforts can produce large numbers of potential suspects, often totalling into the hundreds and even thousands, problems with information overload usually develop.26 “Although a modern police force can fill rooms with details of possible suspects, they still have the enormous problem of finding the vicious needle in their haystack of paper” (Canter, 1994, p. 4; see the discussion on the Gainesville Slayings investigation, in Fox & Levin, 1994, p. 30).

In the still unsolved Green River Killer case, for example, 18,000 suspect names have been collected, but as of February 1992, the police have only had the time and resources to investigate fewer than 12,000 of these (Montgomery, 1993, p. 135-137). The police have gathered 8,000 tangible items of evidence from the

---

26 Canadian and British police officials believe that the performance of their information management systems have much to do with their ability to utilize large amounts of data collected during major inquiries (Green & Whitmore, 1993, pp. 38, 40). In 1990 the United Kingdom had a 90% homicide clearance rate, Canada, 78%, but the United States, only 67%. The application of information theory concepts to the policing process has significant potential (see Krippendorff, 1986).
crime scenes, and a single television special on the case generated 3,500 tips. In Britain, the nation-wide search for the Staffordshire serial murderer amassed details on 185,000 people over the course of 11 years before the child killer was finally caught (Canter, 1994, pp. 3-4).

The Narborough Murder Enquiry, a massive four-year manhunt, obtained close to 4,000 blood samples for DNA testing prior to eventually charging Colin Pitchfork with the deaths of two teenage girls (Canter, pp. 15-16; Wambaugh, 1989). By the time it was solved, the Yorkshire Ripper case had built up a 268,000-name nominal index (Doney, 1990, pp. 101-102). The police had initiated 115,000 actions, visited 27,000 houses, and taken 31,000 statements. Up to 1,000 letters were received daily from the public, and a total of 5.4 million vehicle registration numbers were recorded by investigators (see Nicholson, 1979, pp. 103, 163).

A corollary to the problem of information overload is the high cost associated with any extensive, long-term investigation. The final price of the Atlanta Child Murders investigation was more than $9 million (Dettlinger & Prugh, 1983, p. 106), while the Yorkshire Ripper inquiry involved a total of 5 million hours of police time with an estimated cost of 4 million pounds (1981 figures) (Doney, 1990, p. 102). By early 1992, the still unsuccessful Green River...
Task Force had accumulated expenses of approximately $20 million (Montgomery, 1992).

It is important for police detectives to know which murders are connected, and which ones are not, so that information between related cases can be collated and compared. Confusion over which crimes should form part of a recognized series has developed in several investigations involving serial killers, including Henry Lee Lucas (Egger, 1990, pp. 156-158), Peter Sutcliffe (Burn, 1984), and Clifford Olson (Mulgrew, 1990, pp. 37-39). In other cases, particularly those involving high risk victims, the authorities may not even be aware that a serial murderer is operating within their jurisdiction.

With mobile killers who do not commit their crimes in a single area, the problem of series identification can become much worse. When a criminal investigation has to cross jurisdictional boundaries, issues of coordination, cooperation, and competition arise. This “lack of sharing or coordination of investigative information relating to unsolved murders and to the lack of adequate networking among law enforcement agencies” has been termed linkage blindness (Egger, 1984, p. 348). The problem can even occur within a single police organization if it is large enough. Such an oversight occurred in the early part of the Son of Sam case because David Berkowitz had killed his first victims in
different police precincts within New York City (Leyton, 1986, chap. 5; Ressler & Shachtman, 1992, pp. 198-199).

Several other investigative difficulties exist that complicate efforts to connect linked murders, and to identify and apprehend serial killers (Egger, 1990, pp. 177-179; Holmes & De Burger, 1988, pp. 112-121, 148-154; James, 1991, pp. 1-4; O’Reilly-Fleming, 1992). Such problems include: (1) the intense public, media, and political pressure surrounding such cases; (2) the learning process experienced by organized offenders as they become “practiced” at killing; (3) false confessions from unbalanced people attracted by the publicity surrounding notorious crimes; (4) the possibility of copy cat murders occurring; and (5) the issue of personnel and coordination logistics, especially when multiple jurisdictions and agencies are involved – in the Yorkshire Ripper case, for example, 250 full-time detectives were involved for over a 3 year period (Doney, 1990, p. 102).
Police Strategies

“For heaven’s sake catch me Before I kill more. I cannot control myself” (message written in lipstick on the living room wall of Frances Brown, victim of serial murderer William Heirens; Kennedy, 1991, p. 38).

In efforts to overcome the investigative obstacles faced during serial murder cases, a variety of law enforcement strategies have been developed over the past few years (Egger, 1990, pp. 180-198). One of the most important responses has been the effort to create systems of information management and methods of prioritizing potential suspects so that the investigation can proceed in the most effective and efficient manner possible (Jackson, van den Eshof, & de Kleuver, 1994, pp. 5-6, 22; Ressler & Shachtman, 1992, pp. 136-137). Proper scrutiny of suspects, in the effort to work backwards from them to the victim, is a difficult and time consuming process. Thorough interrogations of suspects, detailed interviews of suspect associates (who may be witnesses, whether they know it or not), and extensive searches for, and analyses of, physical evidence consume valuable and limited resources. By using a methodology to prioritize the police approach, investigative efforts can be tailored to the priority rating of the individual suspect. By focusing on the most probable suspects, the identification of the offender, all else being equal, is more likely to occur sooner.
Kind (1987b, chap. 6, 1990) suggests the use of “frames” and “forms” to help narrow down and prioritize suspects during the course of a police investigation. Frames are flexible and fuzzy enclosures used to delineate potential suspects, while forms are tendencies for groups of people to behave in like fashion. Utilized in conjunction with each other, these concepts can produce combined (intersecting) frames that outline the most productive lines of inquiry. While all criminal investigations can employ this form of information management, the approach is particularly useful in large-scale major inquiries.

*Psychological Profiling*

Psychological profiling\(^{27}\) is one of the primary investigative tools used to prioritize suspects in cases of serial murder. Profiling can be defined as the identification of “the major personality and behavioral characteristics of an individual based upon an analysis of the crimes he or she has committed” (Douglas

\(^{27}\) Psychological profiling is sometimes called criminal personality assessment or criminal behaviour profiling. Both the FBI and the RCMP refer to their work in this area as criminal investigative analysis (CIA). British police, recognizing the contributions of psychology, psychiatry, geography, mathematics, statistics, and detective expertise, use the term offender profiling.
et al., 1986, p. 405). This construction of a behavioural composite – a social and psychological assessment – is based on the premise that the proper interpretation of crime scene evidence can indicate the personality type of the individual(s) who committed the offence. Human action is “the expression of an individual personality structure within a concrete framework of space and time” (Rebscher & Rohrer, 1991, p. 243). Certain personality types exhibit similar behavioural patterns, and knowledge of these patterns or “clue texts” can assist in the investigation of the crime and the assessment of potential suspects.

The use of psychological profiling in the criminal investigation process can be traced to several accurate predications made in 1956 by a psychiatrist, Dr. James A. Brussel, concerning New York City's Mad Bomber (Frank, 1966, pp. 170-171; Holmes, 1989, p. 40; Ressler & Shachtman, 1992, p. 133). A Medical-Psychiatric Committee, formed in 1964 to profile the Boston Strangler, was another early but unsuccessful profiling effort, as its members could not agree on which of the murders were linked (Frank, pp. 95-96, 165-166; Levin & Fox, 1985, pp. 171-174).

Since 1978, investigative support, research, and training in this area has been provided within the United States by the Behavioral Science Unit (now known as the Investigative Support Unit) located at the FBI Academy. The RCMP
Violent Crime Analysis Branch (VCAB), and the Ontario Provincial Police (OPP) Behavioural Sciences Section (BSS), now provide a similar service in Canada (Cavanagh & MacKay, 1991; MacKay, 1994). Psychological profiling in Canada has been modeled upon the FBI approach.

Offences suitable for profiling involve those incidents where the suspect has demonstrated some form of psychopathology and the offence is of an unusual, bizarre, violent, sexual and/or repetitive nature (Geberth, 1981, p. 46). Profiles have been prepared in cases of mutilation, torture, and lust murders, serial killings, homicides involving post-mortem cutting, slashing, evisceration, or body exploration, ritualistic and Satanic or cult crimes, rapes and sadistic sexual assaults, random arsons, child molestings, bombings, bank robberies, and false rape allegations (Cavanagh & MacKay, 1991, pp. 5-6).

Profiling advice is “based on a mixture of operational experience with similar crimes, statistical knowledge gleaned from the analyses of sets of similar cases and knowledge gathered from clinical research and practice” (Jackson et al., 1994, p. 22). Unlike the “just the facts” nature of most investigative methodologies, profiles are composed of probabilistic knowledge concerning the criminal offender, derived from a series of “if-then” rules (Jackson et al., p. 13). Simplified, the process consists of developing answers to the following questions:
1. What happened at the crime scene?

2. What type of person would have done this sort of crime?

3. What are the characteristics usually associated with this type of person?

Perhaps because of this probabilistic nature, profiling requirements are information intensive. In turn, a profile can provide a variety of suggestions concerning offender characteristics including likely age, race, sex, socio-economic status, residence description,\(^{28}\) method of transportation, education level, marital status, employment background, criminal record particulars, psychiatric history, social and sexual development, military history, physical characteristics, habits, degree of organization, pre-offence behaviour, post-offence behaviour, and the possibility of accomplices (Geberth, 1990, p. 499; Ressler et al., 1988, p. 145).

\(^{28}\) Psychological profilers often attempt to provide some estimate of the proximity of the criminal’s residence to the location of the crime scene. This typically is along the lines of such statements as, “the offender likely lives in the neighbourhood of the murders,” or “the killer probably resides or works near the locations of the crime scenes.” Background information necessary for a profile includes, amongst other details, the addresses of the victim’s residence and employment, where he or she was last seen, the locations of the crime sites, and a map of the victim’s travels prior to death (Geberth, 1990, pp. 500-501).
In addition to the criminal profiling of unknown suspects and the establishment of investigative priorities, profiling techniques have been used for a variety of other purposes. These include indirect personality assessments (to assist in developing interviewing or cross-examination approaches), equivocal death analyses, development of investigative and trial strategies, establishing grounds for search and seizure, threat assessments, and informing linkage analyses (Cavanagh & MacKay, 1991, p. 6; Jackson et al., 1994).

Profiling has been censured for several reasons and on several fronts (Jeffers, 1991, chaps. 13-16; Jackson et al., 1994; Jenkins, 1994, pp. 70-72; Levin & Fox, 1985, pp. 174-175; Masters, 1994; Poythress, Otto, Darkes, & Starr, 1993; Rosenbaum, 1993; Turco, 1990). It has been suggested that profiles provide information that is, at best, general and ambiguous, and at worst, misleading. The FBI approach, in particular, has been criticized as wanting programmatic validity and reliability research, and for lacking a proper theoretical basis.

Perhaps the most serious critique to date of profiling (at least of the FBI method) originated from a Congressional review (Jeffers, 1991, chap. 15). The U.S. House of Representatives Armed Services Committee (HASC), while reviewing the Navy investigation of the 1989 explosion on the USS Iowa, became concerned over the manner in which a conclusion of “intentional action” had been
reached (Poythress et al., 1993, p. 8). Gunners Mate Clayton Hartwig was singly blamed for the tragic incident which resulted in the deaths of 47 sailors. He was alleged to have set off an explosion of a 16-inch turret gun in order to commit suicide (Nelson, 1990).

The Naval Investigative Service (NIS) had requested the National Center for the Analysis of Violent Crime (NCAVC) conduct a reconstructive psychological evaluation. This procedure, part of the FBI's profiling service, is termed equivocal death analysis (EDA), and is conceptually similar to a psychological autopsy (Ebert, 1987; Poythress et al., 1993, p. 9; see Fowler, 1986, for example). In suspect cases EDA attempts to determine, through the use of retrospective psychological techniques, manner of death – accidental, suicidal, homicidal, or indeterminate.

The HASC were concerned over the validity and reliability of EDA, and these worries were only exacerbated by the disdain shown by BSU profilers for issues of validity and data integrity (Poythress et al., 1993, pp. 8-9). They asked for assistance from the American Psychological Association (APA), who responded by forming a review panel comprising 12 psychologists and 2 psychiatrists. The majority of the APA experts subsequently found the FBI's analysis invalid, and the panel was unanimous in its criticism of EDA procedures,
methodology, and unarticulated limitations (U.S.S. Iowa Tragedy, 1990). The lack of concern expressed by BSU profilers over validity and reliability was found to be unacceptable (Review of Navy investigation, 1990, p. 253). In short, the FBI did not pass the APA peer review.

Calling the process an investigative failure, the HASC noted that, “The major problem with the Navy investigation is that it fell into the trap of an excess of certitude. Thin gruel became red meat. Valid theories and hypotheses were converted into hard fact” (Poythress et al., 1993, p. 10). The APA expert panel cautioned that, “The conclusions and inferences drawn in psychological reconstructions are, at best, informed speculations or theoretical formulations and should be labeled as such.... The kinds of unequivocal, bottom-line statements offered by the FBI in its EDA report, regarding Clayton Hartwig, are not defensible within the technical limitations of our science” (Poythress et al., p. 12).

This critique contains important warnings regarding the use, limitations, and dangers of psychological profiling. “Profiles should be viewed as supportive and not substantive” (Jackson et al., 1993a, p. 31). The FBI itself cautions that

29 In 1990, Sandia National Laboratories in New Mexico were able to replicate the turret gun explosion through accidental means, further undermining the Navy’s investigative conclusions (Jeffers, 1991, pp. 220-224; Nelson, 1990).
profiling is still more of an art than a science, and should never be considered a replacement for traditional investigative methodologies (Ault & Reese, 1980; Hazelwood & Douglas, 1980; Porter, 1983, 52; Ressler & Shachtman, 1992, p. 9). Dietz (1985), however, feels that "it may be more accurate to regard profiling as a process of logical reasoning that draws on experience, insight, and judgment at each step of the process. In this sense profiling may resemble the process of clinical reasoning in medicine" (pp. 217-218).

The concerns and critiques regarding criminal profiles have led to a variety of evaluation studies designed to examine the investigative merits of the procedure. Evaluative research has occurred in the United States, Britain, and The Netherlands, and is currently being considered in Canada. Such studies have often approached the assessment task by addressing three key issues: (1) how accurate is profiling; (2) how reliable is the process; and (3) how useful are the results?

30 Discussion has taken place in regards to developing automated crime profiling through the use of artificial intelligence and computer-assisted expert systems, but to date this goal has not been realized in North America (Icove, 1986; Reboussin & Cameron, 1989; see also Benfer, Brent, & Furbee, 1991; Brahan, Valcour, & Shevel, 1994; Bunge, 1991). The Netherlands National Criminal Intelligence Division has developed MAMA, however, an expert system designed to support the profiling of rape cases through the computer analysis of crime patterns and offence characteristics (Copson, 1993, p. 14).
These questions provide an important framework for the development of any new investigative methodology, geographic profiling included.

One of the first such evaluation projects was an FBI in-house survey of 192 users of BSU-prepared profiles, comprising 209 cases (65% involving homicide, 35% rape, and 27% other offences)\(^{31}\) (Institutional Research and Development Unit, 1981). The study determined that only 46% of these crimes had been subsequently solved. Of these 88 investigations, the profile was found to have helped: (1) focus the investigation in 72% of the cases; (2) locate possible suspects in 20% of the cases; (3) directly identified the suspect in 17% of the cases; (4) assisted in the prosecution of the suspect in 6% of the cases; and (5) was of no assistance in 17% of the cases.\(^{32}\) Of the 104 unsolved investigations, the profile was still seen as helpful in terms of generating leads, suggesting motives, and confirming other findings. It should be remembered that the BSU typically receives only the most difficult of cases, those that have defied traditional investigative efforts to solve them (Fox & Levin, 1995a; see also Jackson et al., 1994).

\(^{31}\) Percentages do not add up to 100 as a single case may involve more than one type of offence.

\(^{32}\) Percentages do not add up to 100 as multiple responses were allowed.
Pinizzotto and Finkel (1990; see also Jackson et al., 1994; Pinizzotto, 1984) examined criminal profiling outcomes and processes through the expert/novice approach from cognitive psychology used to explore expertise in specific domains. Between-group differences were analyzed in a study that included profilers, police detectives, psychologists, and students. The researchers found that the group of profilers wrote more detailed and valid reports than did the other groups, but they observed mixed results concerning ability to correctly predict offender characteristics. No between-group qualitative differences in information processing were noted.

The Netherlands Institute for the Study of Criminality and Law Enforcement (NISCALE) conducted several evaluation studies of specific profile analysis and investigative advice as provided by the Scientific Advisory Unit of the Dutch National Criminal Intelligence Division (CRI) (Jackson et al., 1994; Jackson, van Koppen, & Herbrink, 1993a, 1993b).

They first explored differences between the operational mental schemata of experienced police investigators and offender profilers (Jackson et al., 1994, pp. 7-13). The cognitive representations and strategies employed by detectives were found to be qualitatively different to those used by profilers. Specifically, the if-then production rules of the police detectives were either too global (general) or
too specific (idiosyncratic) to be of much investigative value. Another component of the study found process differences between an experienced sexual offence detective and an FBI-trained Dutch profiler. The former was observed to work in a bottom-up fashion, concerned with the “what,” while the latter had a top-down approach, and focused on the “who.”

The research revealed interesting differences in how profilers and detectives assimilated data (Jackson, 1994). On average, profilers devoted substantially more time per case on police tip reports (12 hours, 29 minutes vs. 2 hours, 33 minutes) than did detectives, and about the same amount of time on the autopsy reports (14 minutes vs. 16 minutes). Profilers spent less time per case on the main police reports (4 hours, 54 minutes vs. 6 hours, 28 minutes), the geographical locations (18 minutes vs. 31 minutes), and the crime scene photographs (26 minutes vs. 1 hour, 9 minutes). Overall, profilers spent considerably more time than did detectives on data assimilation (18 hours, 21 minutes vs. 10 hours, 57 minutes).

33 The observation that, on average, detectives spent more of their time on the geographic locations than did the profilers (4.72% of total time vs. 1.6%, a factor of 1.7 in terms of absolute time) is interesting in light of one of the findings of Pinizzotto and Finkel (1990): “It was the detective group that scored higher in the homicide questions dealing with the offender’s employment and the offender’s residence in relation to the crime scene” (p. 224).
The NISCALE study also looked at “consumer satisfaction" and found that the great majority of the detective-customers were satisfied with the criminal investigative analysis service (Jackson et al., 1994, pp. 19-21). While the profiles themselves received mixed reviews, it was observed that several other, perhaps more important, functions were also provided (Jackson et al., 1993a, pp. 1, 22). Investigative suggestions, personality assessments, profile writing, crime assessments, interviewing techniques, and threat assessments were all part of the profiler's repertoire.

Detectives noted additional benefits resulting from the profilers’ expertise with bizarre crimes and the fresh perspective they brought to an investigation. "By taking an independent stance, not bogged down with the inconsequential details that a detective actively working on a case has to contend with, the professional profiler can offer directions and advice that can result in the team achieving success in apprehending the culprit" (Jackson et al., 1993a, p. 32).

The NISCALE evaluation discovered that “no criminal was actually caught as a direct result of the profiles made” (Jackson et al., 1993a, p. 24), but this appears to have resulted from problems with customers as well as profilers. While the reports of the profilers were sometimes criticized as being too vague and general, inflexibility on the part of detectives stemming from lack of acceptance,
differences in opinion, financial restraints, time delays, and organizational considerations, all contributed to instances where the profiles were not actually acted upon (Jackson et al., 1993a, pp. 25-27). The CRI now first confirms that sufficient investigative resources exist to follow up any profiling suggestions that might result (Jackson et al., 1994, p. 24).

The NISCALE study concluded that profiling is not an end in itself, but only a management instrument for helping direct certain types of criminal investigations (Jackson et al., 1994, pp. 5-6). The importance of ongoing criminological and evaluative research was also stressed. For example, while an independent study validated some of the derivation principles used in profiling rape cases, other rules were not substantiated within the Dutch context (pp. 14-18). Collaboration within the scientific forum is therefore regarded as an integral component of the CRI's ongoing policies (p. 22).

The Police Research Group (PRG) of the British Home Office is currently undertaking the Offender Profiling Research Programme, a comprehensive evaluation of profiling use within the United Kingdom (Copson, 1993; Davies & Dale, 1995b, pp. 1-3). Interim study results suggest that the perceived usefulness of profiling advice is more associated with the strategic understanding of the crime and its investigation rather than with the profile's inferential aspects (Oldfield,
Such a finding is consistent with the conclusions of the research in The Netherlands (Jackson et al., 1994, pp. 5-6, 22).

Offender profiling in Britain consists of prediction of offender characteristics, establishment of crime series, and provision of investigative advice (see, for example, Canter & Heritage, 1990). It is based on three distinct approaches: (1) practical detective expertise; (2) behavioural science theory; and (3) statistical analyses of solved case information. The behavioural science approach has consisted of two contrasting research threads, one from the area of clinical psychology, and the other from environmental psychology (Copson, pp. 10-12). The latter area has been concerned with drawing geographical as well as behavioural inferences concerning the offender (Canter, 1989, p. 14; Copson, pp. 11-12).

The statistical analysis approach to criminal profiling has its genesis in the development of the CATCHEM database, a collation of all sexually motivated child murders and abductions in Great Britain since 1960 (Aitken, Connolly, Gammerman, & Zhang, 1994, pp. 9-11, 18; Copson, 1993, pp. 12-13). Containing over 2,000 cases, the system also has a refined database of 409 relevant murders and 360 offenders that is used for prediction purposes.
Statistical profiles for unsolved crimes are produced through their comparisons to solved cases in the refined database. These profiles attempt to predict, amongst other characteristics, journey to crime ranges, and in cases of missing bodies, the distance between crime scene and dump site (Copson, 1993, p. 13). Analyses to date of the CATCHEM data suggest that Bayesian belief networks, a graphical method for depicting probabilistic relationships (e.g., between offender, victim, and crime characteristics), show the most promise for statistical modelling (Aitken et al., 1994; Aitken, Connolly, Gammerman, Zhang, Bailey, Gordon, & Oldfield, 1995; see also Iversen, 1984).

In addition to addressing such questions as how useful has offender profiling been in crime investigations, and can the underlying theories be validated against solved cases, the Home Office PRG is building up violent sexual criminal databases, conducting research on the geography of rape, and determining the optimal manner for the delivery of profiling services to police agencies within Britain (Aitken, Connolly, Gammerman, Zhang, & Oldfield, 1995; Copson, 1993; Dale & Davies, 1994a, 1994b; Davies & Dale, 1995b; Farrington & Lambert, 1993). Plans currently exist to develop a National Crime Faculty at the Police Staff College in Bramshill to coordinate offender profiling and related services.
Linkage Analysis

The major response to the problem of linkage blindness has been the establishment of computer systems containing centralized investigative networks and databases. The first such central database developed for serial murder was the NCAVC\textsuperscript{34} Violent Criminal Apprehension Program (VICAP), though Britain and Europe have had modus operandi-based crime notification systems for series detection (the matching of crime with crime, and offence with offender) since 1907 (Brooks et al., 1987, 1988; Green & Whitmore, 1993; Rebscher & Rohrer, 1991, pp. 241-242).

Some states also have their own computerized investigative systems, including the Homicide Investigation Tracking System (HITS) in Washington (Keppel & Weis, 1993), the Homicide Assessment and Lead Tracking (HALT) system in New York, the Homicide Evaluation and Assessment Tracking (HEAT) System in New Jersey, and the Indiana Criminal Apprehension Assistance Program.

\textsuperscript{34} The NCAVC in Quantico, Virginia, was established in 1984 in response to concerns over the rapid increase in violent crime throughout the United States during the previous decade (Depue, 1986). In addition to housing the VICAP program, the NCAVC also contains the ISU, and research and instruction components (Ressler, Burgess, & Douglas, 1988, chap. 7; Van Zandt & Ether, 1994).
(ICAAP) in Indiana. Canada has, through the RCMP, the Violent Crime Linkage Analysis System (ViCLAS) (Johnson, 1994).

While new generations of VICAP-style investigative networks have introduced system enhancements and functional improvements, they are not the only means of establishing connections between crimes. Developments in linkage analysis have also occurred in both behavioural and forensic sciences. One of the functions of psychological profiling is the assessment of the likelihood that one or more crimes were committed by the same offender. Geographical analysis can help disentangle different series of crimes (Canter, 1994, pp. 169-170). Pattern recognition models for linking and predicting serial arsons, based on cluster analysis of variables related to location, time of day, day of week, and modus operandi, have been developed (Icove, 1981; Icove & Crisman, 1975). The London Metropolitan Police Sexual Assault Index can link crime series though the analyses of offender behaviour, including verbal themes (Copson, 1993, p. 13). Offender speech forms have been found to have potential in establishing connections between cases of rape (Dale & Davies, 1994a).

DNA profiling has been heralded as the most revolutionary technology in the field of criminal investigation since the development of the Henry System for fingerprinting (Bigbee, Tanton, & Ferrara, 1989; Burke & Rowe, 1989; Eisner,
1989; Gaudette, 1990; Kelly, Rankin, & Wink, 1987; Lowrie & Wells, 1991; Wambaugh, 1989). Since both semen and blood contain DNA, the potential for ascertaining and verifying links in cases of violent and sexual crimes is significant. One of the necessary steps to realize the potential of DNA analysis is the establishment of centralized indices to facilitate computerized searches and comparisons (Adams, 1989; Miller, 1991, pp. 14-15).

In 1990 the FBI began development of a national DNA identification index, completing the combined Federal, state, and local police agency pilot project in 1993 (Brown, 1994). Designed for the compatible storage and comparison of DNA records, the Combined DNA Index System (CODIS) consists of two investigative indices – the forensic index, for unsolved crimes, and the convicted offender index, for known felons. A missing persons and unidentified bodies index is planned for the future.

One of the important functions of such a system is the establishment of series crimes (Brown, 1994, p. 51). For example, DNA pattern matching linked 18 unknown suspect serial cases together in Minnesota, eventually helping to solve them by matching specimens of two offenders to the crime scenes. Such results are more common in Britain where a DNA database has been in existence for some time (Davies & Dale, 1995b, pp. vi, 19; “DNA profiling,” 1995). While the
Canadian Senate recently passed Bill C-104 authorizing the issuance of DNA search warrants, we currently do not have legislation to support the establishment of a national DNA data bank.

Automated fingerprint identification systems (AFIS) – the method that identified Richard Ramirez as the Night Stalker serial killer (Linedecker, 1991, pp. 121-129) – are becoming increasingly common in police agencies, allowing comparisons and matches that, in the past, sheer work volume would have precluded (Sparrow, 1994). And systems now exist with the potential, through computerized comparisons of ballistic patterns, to link crimes committed with firearms (Dees, 1994; Strandberg, 1994; see also Davis, 1958; Di Maio, 1985).

*Other Investigative Tactics*

Egger (1990, pp. 180-198) identifies additional responses that have been used or are being developed and experimented with by police agencies to assist in solving cases of serial murder (see also U.S. Department of Justice, 1991b). These investigative approaches include:
• the organization of law enforcement conferences focused on a specific series of solved or unsolved murders (see Green & Whitmore, 1993). The RCMP have sponsored two such conferences in Canada to examine prostitute homicides. In 1991, Project “Eclipse” assessed 25 unsolved murders in Vancouver, and in 1993, Project “Kayo” examined 14 such crimes in Edmonton (MacKay, 1994, pp. 11-12; see also Lowman & Fraser, 1995).

• the establishment of clearinghouses to provide information on an ongoing basis to police agencies involved in investigating serial murders.

• the formation of task forces, which can be set up at the local level, or in cases of multi-jurisdictional crimes, at the regional level.

• the use of investigative consultant teams, composed of investigators with experience in similar cases, to provide advice and assistance to the agency responsible for the serial murder investigation (see Brooks, 1982; Brooks et al., 1988).

• the development of improved computerized analysis systems. In Britain, for example, Scotland Yard uses the Home Office Large Major Enquiry
System (HOLMES) for managing large volumes of investigative case data (Doney, 1990).

- the application of geographical pattern analysis. Egger (1990, p. 197) states that geographical pattern analysis, or geoforensics (Newton & Newton, 1985; Newton & Swoope, 1987), is a research area worthy of further development.

- the paying of a serial murderer for evidence. To date, this has only occurred in the Clifford Olson case in British Columbia, Canada (Bayless, 1982; Mulgrew, 1990).

Police departments have also used psychics to help search out clues (see Dettlinger & Prugh, 1983, pp. 83-92; Lyons & Truzzi, 1991, chap. 11), and have been involved in the production of special television programs designed to elicit tips, bring forward witnesses, and bring about designed responses in the murderer. It is worthwhile stressing that normal investigative techniques, routine police patrol work, unsolicited suspect confessions, and sheer luck have all played a significant role in the solving of cases of serial murder (Canter, 1994, p. 198; Keppel, 1989, pp. 66-68; Levin & Fox, 1985, p. 185).
The Geography of Serial Murder

My only concerns was being prepared ... Some Saturdays and Sundays I drove along the Coast, not looking for hitch-hikers, just searching out places. On back-waters of the Pee-Dee River, near where I had worked with the cypress cutting and hauling crews, I found old logging roads that went for miles into the swamps – and more trails into marshes south of Georgetown ... I decided on spots I could get to quick from main Highways, but far enough away so I wouldn’t have to worry about anybody seeing or hearing, and I always picked spots that had a nice burying place close by. (Donald “Pee Wee” Gaskins, planning his South Carolina coastal kills; Gaskins & Earle, 1993, p. 123)

Most research and commentary on the geography of serial murder has been descriptive, aimed primarily at the categorization of spatial patterns of crime scenes. Such studies appear to have examined body dump, rather than victim encounter or murder sites, although this selection is rarely articulated. Other works have analyzed regional trends at a macrolevel (see Cavanagh, 1993; Hickey, 1991, pp. 77-79; Levin & Fox, 1985, pp. 60-64). These findings are usually presented in terms of counts, rather than in rates, which limits their interpretation.

Holmes and De Burger (1988, pp. 49, 54, 73; see also Falk, 1990, p. 92) describe serial murder location patterns as either: (1) concentrated (characteristic of the visionary, mission-oriented, hedonistic lust, and hedonistic comfort serial
murderer types); or (2) dispersed (characteristic of the hedonistic thrill, and power/control-oriented serial murderer types). Thus serial killers are: (1) geographically stable (concentrated target patterns); (2) geographically transient (dispersed target patterns); or (3) mixed (a combination of stable and transient). Holmes and De Burger note that the motives of geographically stable serial killers are often sexual in nature, and their victims specifically selected. Transportation of the victim's body is a crime scene characteristic associated with the lust, thrill, and power/control-oriented serial murderer types (Holmes, 1989, p. 71).

Robbins (1991) researched differences in the methods and motives of geographically stable and geographically transient serial murderers. In a study of 20 well-known recent (1970 to 1991) convicted and incarcerated male serial killers, she found that geographically stable serial murderers usually operated in those areas composed of people of their own race, sought specific victim traits, were organized, and planned their crimes in advance (pp. 63, 103-105, 108-112). They tended to be thrill oriented, young, and often committed their crimes under the influence of alcohol and/or drugs. They would leave their victims' bodies clothed, engaged in necrophilia, and sometimes decapitated their victims (for the purposes of delaying victim identification). Body dump sites were different from murder scenes (necessitating transportation of the victim's body), and both
locations were chosen by the killer ahead of time. The remains of their victims were usually discovered.

Geographically transient serial murderers, by comparison, were more likely to have a history of sexual abuse in their backgrounds, tended to be less organized, and had shorter attention spans (Robbins, 1991, pp. 105-112). This usually resulted in a lower level of formal education, more marital breakdowns, a record of working odd jobs, and a propensity for not staying in one place very long. They were not as victim specific, and less ritualistic in their crimes, often changing their choice of weapons and methods of operation. They tended to be power/control-oriented, older, and would often travel extensively. Their victims' bodies were usually left unclothed, and were more frequently inflicted with acts of biting and cannibalism by the killer (see Wilson, 1988, pp. 80-82). The remains of their victims were less likely to be found.

_____________________________

35 Dietz, Hazelwood, and Warren (1990, pp. 169-170) found that 93.3% (28) of the sexually sadistic criminals they studied had carefully planned their offences, 76.7% (23) took their victims to a preselected location, and 60% (18) kept at least one of their victims captive for 24 hours or more (see, for example, Gaskins & Earle, 1993, p. 123). To a profiler, cases of extended captivity indicate an offender with access to a safe and secure place to hold the victim (Ressler & Shachtman, 1992, p. 99).
Table 1 summarizes some of the target pattern characteristics believed to be associated with the various categories in the Holmes and De Burger serial murderer typology (including Barrett’s opportunist serial killer type) (Barrett, 1990, p. 168; Holmes, 1989, pp. 70-73; Holmes & De Burger, 1988, pp. 77-81; Robbins, 1991, pp. 103-112).

<table>
<thead>
<tr>
<th>Serial Murderer Type</th>
<th>Victim Selection</th>
<th>Method</th>
<th>Crime Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visionary</td>
<td>known &amp; stranger</td>
<td>spontaneous</td>
<td>concentrated</td>
</tr>
<tr>
<td></td>
<td>nonspecific</td>
<td>disorganized</td>
<td></td>
</tr>
<tr>
<td></td>
<td>random</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mission-Oriented</td>
<td>stranger</td>
<td>planned</td>
<td>concentrated</td>
</tr>
<tr>
<td></td>
<td>specific</td>
<td>organized</td>
<td></td>
</tr>
<tr>
<td></td>
<td>nonrandom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hedonistic Lust</td>
<td>stranger</td>
<td>planned</td>
<td>concentrated</td>
</tr>
<tr>
<td></td>
<td>specific</td>
<td>organized</td>
<td>body movement</td>
</tr>
<tr>
<td></td>
<td>random</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hedonistic Thrill</td>
<td>stranger</td>
<td>spontaneous</td>
<td>dispersed</td>
</tr>
<tr>
<td></td>
<td>specific</td>
<td>disorganized</td>
<td>body movement</td>
</tr>
<tr>
<td></td>
<td>random</td>
<td></td>
<td>geographically stable</td>
</tr>
<tr>
<td>Hedonistic Comfort</td>
<td>known &amp; relational</td>
<td>planned</td>
<td>concentrated</td>
</tr>
<tr>
<td></td>
<td>specific</td>
<td>organized</td>
<td></td>
</tr>
<tr>
<td></td>
<td>nonrandom</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In a study of 28 convicted serial sex murderers who targeted female victims, James (1991, chap. 39) noted various characteristics related to hunting behaviour and crime site geography. He recorded the following data on victim selection, hunting behaviour, offender transportation, attack, body disposal, and apprehension:

Table 1. Characteristics of the Holmes and De Burger Serial Murderer Typology.

<table>
<thead>
<tr>
<th>Serial Murderer Type</th>
<th>Victim Selection</th>
<th>Method</th>
<th>Crime Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power/Control-Oriented</td>
<td>stranger</td>
<td>planned</td>
<td>dispersed</td>
</tr>
<tr>
<td></td>
<td>specific</td>
<td>organized</td>
<td>body movement</td>
</tr>
<tr>
<td></td>
<td>nonrandom</td>
<td></td>
<td>geographically transient</td>
</tr>
<tr>
<td>Opportunist</td>
<td>stranger</td>
<td>spontaneous</td>
<td>dispersed</td>
</tr>
<tr>
<td></td>
<td>nonspecific</td>
<td>disorganized</td>
<td></td>
</tr>
<tr>
<td></td>
<td>random</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Victim Selection

(a) 89% of the serial murderers did not know their victims before the crime, and 29% had met or previously seen at least one of their victims (some killers attacked both strangers and acquaintances);

(b) 50% of the serial murderers offered their victims rides, 11% met them in bars, and 7% contacted them through newspaper advertisements;

(c) 86% of the serial murderers randomly selected their victims; and

(d) 25% murdered prostitutes, and 21% were attracted to children (girls under the age of 12 years).

2. Hunting Behaviour

(a) 32% of the serial killers planned their murders in advance, and 61% were familiar with the area where the crime was committed;

(b) 18% followed, and 18% hunted their victims; and
(c) 46% operated with an accomplice (9 with a male, and 4 with a female co-killer).

3. Transportation

(a) 78% of the serial murderers used vehicles, either directly or indirectly, in the commission of their crimes;

(b) 50% of those who directly used vehicles in their crimes had offered their victims rides;

(c) 63% of the time the vehicle involved was the killer’s own, registered either to him (54% of the time) or to a relative, and 18% of the time the vehicle involved was stolen; and

(d) only 7% of the killers used public transportation, and only 4% used an aircraft.

4. Attack

(a) 75% of the serial murderers conned their victims to gain control, and 68% used a ruse to get their victims to the attack location;

(b) 21% used immediate force to gain control of their victims; and
(c) 32% of the killers attacked their victims on their own property, 29% on the property of a relative or friend, and 29% in the victim’s residence.

5. Body Disposal

(a) 64% of the serial murderers tried to conceal their victims’ bodies in remote areas;

(b) 29% of the killers buried their victims underground, and 21% dumped them in water; and

(c) 68% of the killers moved the bodies of their victims after the murder.

6. Apprehension

(a) at least 61% of the serial murderers had a previous criminal record;

(b) 11% of the killers had been observed within the crime area by the police, and 18% were connected to the crime area by patrol officers;
(c) 29% had been questioned and then released;

(d) 14% of the killers were arrested through surveillance methods, and 8% through patrol work;

(e) overall, 31% were caught as the direct result of police investigation activities, and 61% as the direct result of witness information; and

(f) 32% of the serial murderers had kept incriminating evidence at their home or workplace, and 29% on their person or in their vehicle (some murderers may have done both).

Wingo dichotomizes serial killers into those who are either "megastat," a murderer who "commits killings over time in a single static urban environment," or "megamobile," a murderer who is "mobile, moving over great stretches of geography as he commits his killings" (Egger, 1990, pp. 26-27). In their study of sexually sadistic criminals, Dietz et al. (1990, pp. 168-169) found that 40% (12) of the subjects engaged in "excessive driving" (travelling long distances or with no clear direction). Davies and Dale (1995b, pp. v, 12, 18-19) found several of the
offenders in their study of British rapists were incessant prowlers, cruising by vehicle, public transportation, or on foot.  

Mobility, however, does not necessarily translate into range. Keppel (1989) observes that “serial killers are highly mobile, frequently cruising and drawn to those victim contact areas where they feel they are in their ‘comfort zone’” (p. 65; see also Canter, 1994, p. 188). These offenders usually have ready access to vehicles which they use to become familiar with their preferred victim encounter and body disposal areas. He cites the examples of Wayne Williams and John Wayne Gacy, Jr., both of whom confined their murderous activities to a single metropolitan area – respectively, Atlanta and Chicago. So the mobility associated with serial murderers may result in a higher frequency of cruising, and not necessarily in a greater geographic reach.

In his study of serial murder in the United States from 1795 to 1988, Hickey (1991, pp. 17, 78-81, 132-138) used three geographic categories of serial killers: (1) travelling (those who commit murder while moving through or relocating to other areas, comprising 28% of all such offenders); (2) local (those

---

36 They also note the investigative importance of police recording information on prowlers, trespassers, and suspicious persons. Viable sexual assault suspects can often be found through such records queried by geographic area.
who remain within a certain urbanized area or state, comprising 45% of all such offenders); and (3) place-specific (those who murder within their own home, workplace, or some other specific site, comprising 27% of all such offenders).

In a typology similar to Hickey's, Newton (1992, pp. 48-49) breaks down serial murderers by hunting style into: (1) territorial killers, who stake out a defined area (comprising 63% of U.S., and 70% of non-U.S. cases); (2) nomadic killers, who travel widely in their search of victims (comprising 29% of U.S., and 15% of non-U.S. cases); and (3) stationary killers, who commit their crimes at home or work (comprising 8% of U.S., and 15% of non-U.S. cases). Newton's study comprised 301 U.S. and 56 non-U.S. cases in a 20 year period (p. 4). He observes that few serial murderers change their hunting style, a technique which he feels expresses their view of life and who they are.

Hickey (1991, p. 80) discovered a shift in mobility patterns occurring since 1975. Travelling out of state killers dropped to 23% of the total and there was a reduction in the proportion of place-specific serial killers to 19%, probably due to changes in methods of killing and advances in techniques of forensic analysis. Finally, there was an increase in the number of local killers to 58%, possibly resulting from the effects of increased urbanization in North America.
These results contradict the generally held assumption that serial killers are highly peripatetic (Egger, 1984, p. 352; Keppel, 1989, p. 65). This iconoclasm was repeated by Levin and Fox (1985), who found that “traveling serial killers ... are a minority to those ... who ‘stay at home’ and at their jobs, killing on a part-time basis” (p. 183). Barrett (1990, p. 42) also concluded that serial murderers tend to be geographically stable, killing in areas that they know. He suggests that “turf” is one of their key characteristics, and observes that it is rare for such offenders to hunt in an area already besieged by another serial murderer (though such a finding may best be explained by the rarity of the phenomenon). Newton (1992) comments that the majority “rarely deviate from the selected game preserve” (p. 48). Perhaps executed serial murderer Donald “Pee Wee” Gaskins said it best: “I felt safer doing my killing and burying in my home state. I guess I’m just a Carolina Southern-boy at heart” (Gaskins & Earle, 1993, p. 161).

Hickey (1991, pp. 80-81) notes that local serial killers murdered fewer victims per offender than did those in the other two categories. This may be because highly mobile serial killers are hard to apprehend for a variety of reasons, not the least of which is linkage blindness (Egger, 1990, chap. 8), and place-specific murderers often hide the bodies of their victims on their premises so the
police may not be aware that the victim disappearances are connected, or even that they are homicides.

Compared to other homicide victims, those killed by serial murderers are more likely to be attacked outside of their homes. Hickey (1991, pp. 80-81) suggests that this may be due to their vulnerability in those areas to which such killers have easy access. It is also related to the lack of relationship between victim and offender in most cases of serial murder, in contrast to most homicides which involve intimates.

Hickey (1991, pp. 94-95) found that female serial child killers are more likely (71% vs. 24%) than their male counterparts to be place-specific, and male serial child killers more likely (32% vs. 11%) to be travellers. Such a result is probably reflective of the institutional nature (e.g., hospitals, boarding houses) of the place-specific locations involved (Segrave, 1992, pp. 1-6). This is supported by the findings of Scott (1992, pp. 49-51) who determined that most employed female serial murderers use their occupational position to access victims.

While such descriptive accounts of serial murder geography are useful, a greater understanding of the microlevel spatial behaviour of these types of killers can be gained by applying theories and techniques borrowed from environmental criminology and quantitative geography (Brantingham & Brantingham, 1984; R. V.
As part of the present study of serial murder target patterns, it was necessary to develop a typology of offender hunting (i.e., target search and victim attack) methods. Within a geography of crime perspective, locations of crime sites were seen to be influenced by hunting style, target backcloth, and changes in offender activity space. Such an approach calls into question notions of "randomness." The serial killer hunting typology is presented in Chapter 4, and the concept of victim randomness is further discussed in Chapter 5.
CHAPTER III

THE GEOGRAPHY OF CRIME

The methodological and theoretical approaches developed in a variety of disciplines have often been adopted to the study of crime and criminals, and the fields of geography and urban analysis have provided several analytical tools for criminologists. Perspectives that have made particular use of geographic techniques include the social ecology of crime, environmental criminology, the geography of crime, the routine activities approach, situational crime prevention, and problem-oriented policing (Brantingham & Brantingham, 1981b, pp. 7-26; Brantingham & Jeffery, 1981, pp. 227-237; R. V. Clarke, 1992, Pt. 1; Felson, 1986; Goldstein, 1990, pp. 66-70; Lowman, 1986, pp. 81-82; Smith, 1986, pp. 1-26). Work in such areas has provided the conceptual foundations for the current research.

Geography and Crime Studies

Geographical patterns in crime have been noted since the mid-nineteenth century pioneering work of A. M. Guerry and Adolphe Quetelet who mapped, on a
national basis, violent and property offences and examined their spatial relationship to poverty (Brantingham & Brantingham, 1981c, p. 10; Vold & Bernard, 1986, pp. 39, 131-132). The most famous spatial crime studies were conducted in the early twentieth century, when the city of Chicago served as a source of inspiration and a field for experimentation for University of Chicago sociologists (Warren, 1972, p. 26; Williams & McShane, 1988, pp. 34-35). The geographical focus of criminology had now shifted from regional areas to city neighbourhoods.

The Chicago School's human ecology and the theories of urban growth, developed by Robert Park and Ernest Burgess, served as guides for former probation officer Clifford R. Shaw and his colleague Henry D. McKay (Brantingham & Brantingham, 1984, pp. 305-308; Vold & Bernard, 1986, pp. 164-165). While working for the Illinois Institute for Juvenile Research, Shaw and McKay examined a plethora of urban social ills, including the politically important issue of crime (Williams & McShane, 1988, pp. 34-45; Wilson, 1984, pp. 546-560).

Much of this study was done along the margins of society; researchers observed, talked to, and examined criminals, gang members, hoboes, immigrants, and slum dwellers. Most importantly, they did this within the "natural" urban
contexts associated with the people they were studying. This attempt to triangulate the subjective human perspective with more objective demographic statistics exemplified the work of the Chicago School (Smith, 1986, pp. 8-9).

While there is a long tradition of spatial crime analysis, it is important to remember that the ultimate units of concern are often not census statistics or demographic data, but individual human beings and their day-to-day social interactions. This point seems to have been forgotten during the unfruitful positivistic geographic research of the 1960s, when complicated but theoretically weak factor analytic methods were used to correlate a spectrum of spatially distributed variables (Smith, 1986, p. 7; Young, 1986, pp. 4-6).

The development of spatial studies of crime since the 1970s has been much more promising. The integration of geographical perspectives, urban planning tactics, environmental criminology, and ecological approaches based on econometric studies has led to a series of interesting studies (Brantingham & Brantingham, 1981a; Lowman, 1986, p. 81; Smith, 1986, pp. 7-9). While the field has been primarily instrumentalist in nature, writers such as Lowman and Smith have commenced the development of a critical geography of crime, and left realists have begun to be concerned with the situational and spatial nature of crime (Kinsey, Lea, & Young, 1986; Lea & Young, 1984).
An awareness of certain geographic concepts and terms can help in the analysis of criminal target patterns, and for an understanding of the model of crime site selection proposed by Brantingham and Brantingham (1981, 1984, chap. 12) – necessary elements in the development of a method to predict offender residence from crime locations. Some of these ideas are presented below.

**Centrography**

The spatial mean (sometimes referred to as the centroid or mean centre) is a univariate measure of the central tendency of a point pattern (Taylor, 1977, pp. 23-27), and it has been used by some researchers to help analyze crime site patterns. This geographic “centre of gravity” minimizes the sum of the squared distances to the various points in the pattern. It provides a single summary location for a series of points and has a variety of geostatistical uses, which are sometimes classified together as centrography. The spatial mean is defined as:
where:

\[ (SM_x, SM_y) \]

and:

\[ SM_x = \frac{\sum_{c=1}^{T} x_c}{T} \]

\[ SM_y = \frac{\sum_{c=1}^{T} y_c}{T} \]

and:

- \( SM_x \) is the \( x \) coordinate of the spatial mean;
- \( SM_y \) is the \( y \) coordinate of the spatial mean;
- \( T \) is the total number of crime sites; and
- \( x_c, y_c \) are the coordinates of the \( c \)th crime site location.

The spatial mean can serve as the basis for calculating the standard distance of a point pattern, a measure of spatial dispersion analogous to the standard deviation (Taylor, 1977, pp. 27-30). Such measures can help describe two-dimensional distributions, and through the concept of relative dispersion (the ratio...
of two standard distances), allow for comparisons of spread between different sets of points. The standard distance is defined as:

\[
Sd = \sqrt{\left( \sum r_{cs}^2 \right)/T}
\]  

(4)

where:

- \( Sd \) is the standard distance;
- \( T \) is the total number of crime sites; and
- \( r_{cs} \) is the distance between the spatial centre and the cth crime site location.

Changes over time in the location of the spatial mean also allow for the calculation of the geographic equivalents of the concepts of velocity (rate of spatial change), acceleration (rate of change in velocity), and momentum (velocity multiplied by the number of points) (LeBeau, 1987b, pp. 126-128).

Centrography has been used to examine the spatial mean for rape, and changes in its location over time, in the city of San Diego (LeBeau, 1987b). An investigative review team helped locate the home town of the Yorkshire Ripper
through the calculation of the spatial mean for the murder sites (Kind, 1987a). Such techniques have also been used in a retrospective analysis to focus in on the residential area of Angelo Buono, one of the Hillside Stranglers (Newton & Swoope, 1987). And the FBI has done some centrographic analysis of serial arson sites (Canter, 1994, p. 115; Icove & Crisman, 1975). Thus far, centrography has been the primary form of spatial analysis employed in geographic investigative support efforts.

Studies of journey to crime trips, particularly those which are offence specific, can help determine the most likely radius within which offenders search for victims. For example, the research has consistently shown that targets are usually located within one or two miles of offender residence (see McIver, 1981, pp. 22, 24-25). When utilized in conjunction with the spatial mean, such information may be of assistance in certain police investigations. “Like a person going shopping, a criminal will also go to locations that are convenient” (Canter, 1994, p. 187).

As useful as centrographic analysis is in certain cases, the spatial mean suffers from three serious methodological difficulties: (1) it generally provides only a single piece of information; (2) it can be distorted by spatial outliers; and (3) some theoretical models suggest that the intersection between offender activity
space and target backcloth (the distribution of crime targets across the physical landscape) may yield crime sites unrelated to measures of central tendency. For example, if the activity space of an offender is not centred around his or her home, or if the target backcloth is highly variable, then the spatial mean of the crime locations will not be correlated to offender residence.

The results of a study of the spatial target patterns of a sample of British serial rapists revealed some of the limitations of centrographic analysis (Canter & Larkin, 1993, pp. 67-68). When maximum distance from residence to crime site was plotted against maximum distance between crime sites, the resulting regression equation was produced:

\[ y = 0.84x + 0.61 \] (5)

where:

\[ y \] is the maximum distance from residence to crime site; and
\[ x \] is the maximum distance between crime sites.
The gradient of 0.84 in Equation 5 indicates an eccentric placement of the residence vis-à-vis the crime sites (a perfect centric placement would yield a gradient of 0.5). This eccentricity suggests that the spatial mean is limited in its ability to predict offender residence location.

Additionally, the spatial mean can lack real world significance. The geographic centre of Canada is in the Northwest Territories which tells one little about the demographic, economic, or political patterns of this country. LeBeau (1987b) notes that “an important property about the mean center to remember is that it is a synthetic point or location representing the average location of a phenomenon, and not the average of the characteristics of the phenomenon at that location” (pp. 126-127; see also Taylor, 1977, p. 27).

Nearest Neighbour Analysis

While the spatial mean provides a way to measure central tendency in a point pattern, nearest neighbour analysis, first developed by plant ecologists, supplies a way to quantify spacing between points (Taylor, 1977, pp. 156-168; for a discussion of other forms of point pattern analysis, see Boots & Getis, 1988; Garson & Biggs, 1992, pp. 54-70; Taylor, chap. 4). Distances between points and
their closest neighbours provides important information concerning a pattern’s degree of randomness and underlying evolution. It is also possible to calculate other proximity pattern measures including centroid, average interpoint, and furthest neighbour distances (Garson & Biggs, p. 61).

Since the Poisson probability function is known to be associated with random processes, the degree of clustering, dispersion, or randomness in a given point pattern can be assessed using nearest neighbour analysis (Taylor, 1977, pp. 156-157). The $R$ scale, the ratio between the actual average nearest neighbour distance and that expected under an assumption of randomness, provides a simple index for measuring divergence from randomness. It is calculated as follows:

$$ R = \frac{r_a}{r_e} $$ (6)

where:

$$ r_e = \frac{1}{2} \sqrt{\frac{n}{A}} $$ (7)
and:

\[ R \] is the R scale value;

\[ r_a \] is the actual average nearest neighbour distance;

\[ r_e \] is the expected average nearest neighbour distance;

\[ n \] is the number of points; and

\[ A \] is the area of the study region.

The R scale can theoretically fall between the limits of 0 to 2.149, though in practice real world patterns tend to range between 0.33 and 1.67 (Taylor, 1977, pp. 157-158). A value of 1 (meaning that \( r_a = r_e \)) indicates a random pattern, values smaller than 1, a clustered pattern, and values larger than 1, a dispersed pattern. Problems can result in the interpretation of the R scale, however, if boundary placement is distorted (Garson & Biggs, 1992, pp. 60-61).

Since it is possible that a randomly produced pattern could, by chance, appear to be aggregated or dispersed, it is necessary to determine the significance of the R scale value (Taylor, 1977, pp. 159-162). This can be easily accomplished through a Z-score calculated from the standard error of the expected average nearest neighbour distance. The associated two-tailed probability may then be
determined from a table of normal distribution values (e.g., Blalock, 1972, p. 558). The standard error (SE) can be estimated as follows:

\[ SEr_e = \frac{0.26136}{\sqrt{n^2/A}} \]  

(8)

where:

- \( SEr_e \) is the standard error of the expected average nearest neighbour distance \( (r_e) \);
- \( n \) is the number of points; and
- \( A \) is the area of the study region.

It should be noted that while the R scale provides a measure of spatial randomness, it says nothing about the actual evolution of the point pattern. More than one distinct process may be operating as might be found with a series of chaotic binary points (Boots & Getis, 1988, p. 39). Any conclusions can only be inferred from statistical tests, and it may be appropriate to corroborate results over time or to examine higher-order (e.g., second nearest) neighbour distances.
Movement and Distance

One of the most basic heuristics in geography is the nearness principle, also known in psychology as the least-effort principle (Zipf, 1950). A person who is "given various possibilities for action ... will select the one requiring the least expenditure of effort" (Reber, 1985, p. 400). This maxim describes a great deal about the movement of people, but it is important to remember that many factors come into play in the psychology and behaviour of choice (Cornish & Clarke, 1986; Luce, 1959; Tversky & Kahneman, 1981).

According to the least-effort principle, when multiple destinations of equal desirability are available, all else being equal, the closest one will be chosen. The determination of "closest," however, can be a somewhat problematic assessment. Isotropic surfaces, those spaces exhibiting equal physical properties in all directions, are rarely found within the human geographical experience. Instead, people are usually confronted with anisotropic surfaces where movement is easier in some directions or along certain routes, and harder along others. People travel through networks of roads and highways by "wheel distance" (Rhodes & Conly, 1981, pp. 177-178) rather than by Euclidean distance.

Other factors can be just as important as physical space. Macrolevel travel choices are usually influenced by time and money expenditures. Airline bookings
are made by considering connections, time, and cost – not by actual distances covered. Income and socio-economic status thus have an important influence on spatial behaviour, as a shortage or lack of financial resources will constrain choices and determine which options are seen as viable.

Microlevel movement within cities is similarly affected; urban areas are primarily anisotropic, often conforming to some variation of a grid or Manhattan layout\(^\text{37}\) (Lowe & Moryadas, 1975, pp. 15-17), with dissimilar traffic flows along different routes. As it is not just a question of minimizing distance, but of reducing time, effort, and costs, the layout of the city, the offender’s modes of transportation, and any significant mental or physical barriers must also be considered in the spatial analysis of crime patterns (Canter, 1994, pp. 110, 127-129).

\(^{37}\) Canter and Larkin (1993, p. 68), however, suggest that studies of movement within different city structures may require different metrics. While the grid (Manhattan) pattern describes most North American cities, crow-flight measures have been found to be useful for studies placed in British cities. They suggest that the appropriate metric for analyzing offender movement may be related to “the internal representation of the environment that forms the basis of the criminal’s actions.”
The subjective psychological perception of distance is just as critical as the objective physical space involved (Canter & Tagg, 1975). An individual's perception of distance is influenced by several factors, including (Stea, 1969):

(1) the relative attractiveness of origins and destinations;

(2) the number and types of barriers separating points;

(3) familiarity with routes;

(4) the actual physical distance; and

(5) the attractiveness of routes.

So while the nearness principle may seem to be simple, its actual implementation is quite complicated, requiring an awareness of both objective (physical) and subjective (cognitive) factors. In understanding human movement, then, it is just as important to take into account mental or cognitive maps and their creation as it is to consider physical maps (see Canter, 1977; Canter & Larkin, 1993, pp. 63-64, 68).
Mental Maps

Mental maps,\textsuperscript{38} cognitive images of such familiar areas as neighbourhoods or cities, are formed from a distillation of the particular transactions a person has with his or her surroundings (Canter, 1994, pp. 109, 116). Unlike such animals as hummingbirds who can retain detailed images of their spatial experiences, humans generalize such knowledge within their memories. Since a target cannot be victimized unless an offender is first aware of it, mental maps have an influence on crime site selection. Goodall states:

A mental map is a representation of the spatial form of the phenomenal environment which an individual carries in his or her mind. The representation is of the individual’s subjective image of place (not a conventional map) and not only includes knowledge of features and spatial relationships but also reflects the individual’s preferences for and attitudes towards places.... The product of this process, at any point in time, is a mental or cognitive map and can be shown cartographically as a perception surface. (p. 299)

\textsuperscript{38} Lowe and Moryadas (1975, p. 134) suggest that because we spatially interact with many different areas, people actually require several maps, and thus it is possible to speak of mental atlases.
These images are the result of the reception, coding, storage, recall, decoding, and interpretation of information, and the resulting cognitive maps may involve nonspatial dimensions such as colour, sound, feeling, sentiment, and symbolization (Brantingham & Brantingham, 1984, p. 358; Clark, 1990, p. 64).

Geographic information is an important determinant of movement and, as Gould (1975, p. 99) observes, one’s social, employment, educational, and economic position is critically related to the acquisition of spatial information. The information people hold often contains gaps, and ignorance barriers may form based on linguistic, political, natural, religious, and cultural differences (Brantingham & Brantingham, 1984, p. 355; Gould & White, 1986, chap. 4). Spatial interaction is thus influenced by the actor’s location, both geographic and social, and the knowledge or perception held of viable movement options (for a discussion of the influence of geographic information on burglary target selection, see Rengert & Wasilchick, 1985, chap. 3).

While cognitive images may vary in relation to a person’s biography, social class, geographical location, and environment, most people’s mental maps have much in common. This is due to the fact that humans tend to perceive things in like fashion. Lynch (1960, pp. 47-48), for example, states that image composition is based on five elements:
(1) paths (routes of travel that tend to dominate most people’s images of cities; e.g., highways, railways);

(2) edges (boundaries of lines that help to organize cognitive maps; e.g., rivers, railroads);

(3) districts (subareas with recognizable unifying characteristics, possessing well-established cores but fuzzy borders; e.g., financial districts, skid roads);

(4) nodes (intense foci of activity; e.g., major intersections, railroad stations, corner stores); and

(5) landmarks (symbols which may not be entered but which are still used for orientation; e.g., signs, buildings, trees).

Awareness and Activity Space

A person’s mental map is developed from their awareness space, the latter being composed of:

all the locations about which a person has knowledge above a minimum level even without visiting some of them ... Awareness space includes activity space (the area within which most of a person’s activities are
carried out, within which the individual comes most frequently into contact with others and with the features of the environment), and its area enlarges as new locations are discovered and/or new information is gathered. (Clark, 1990, pp. 24-25)

The activity space can be defined as “the space in which the majority of an individual’s activities are carried out, i.e. those places visited regularly by an individual” (Goodall, 1987, p. 14), and contains those “places and connecting routes which comprise a person’s habitual geography on a daily or weekly basis” (Jakle, Brunn, & Roseman, 1976, p. 303; see also Brantingham & Brantingham, 1984, p. 349). “Where we go depends upon what we know ... What we know depends on where we go” (Canter, 1994, p. 111).

Some writers use the term action space rather than activity space (though this designation is sometimes also applied to awareness space). Lowe and Moryadas (1975) state that:

In the short run, mental maps provide the outer limits of potential action space, which may be defined as that area which contains the majority of destinations of a particular individual. It is a subspace within the mental map and frequently tends to be discontinuous in the sense that between certain preferred areas there are some stretches of unknown, possibly undesirable, territory. The configuration of action spaces is frequently linear, especially in automobile-oriented societies. Moreover, from an individual’s home base, the movement patterns that define the action space
may have well-marked directional biases so that the elongation in one
direction is offset by an attenuation in other directions. (p. 139)

Anchor Points

Within a person's activity space are anchor points or bases, the places of
most importance in their spatial life (Coucelis, Golledge, Gale, & Tobler, 1987).
For the vast majority of people this includes their residence, but others may have
bases elsewhere, perhaps the work site or a close friend's home. It should be
remembered that some street criminals do not have a fixed address, and may base
their activities out of a bar, pool hall, or some other such social activity location
(Rengert, 1990, pp. 4-5). They might also be transient, homeless, living on the
street, or mobile to such a degree that their anchor point constantly shifts.

Rengert (1990) notes the importance of the criminal offender's anchor point
in understanding patterns of crime:

Especially significant are the "anchor points" which focus the routine
activities of criminals on specific sites in our urban environments.... If a
criminal routinely visits the same location nearly every day, this location
may serve as an "anchor point" about which other activities may cluster.
This proposition is implicitly recognized when we document that most
crime occurs near the home of the criminal (Brantingham and Brantingham,
1984). The home is the dominant anchor point in the lives of most individuals. However, other anchor points also are important influences on the spatial behavior of criminals. (pp. 4-5)

Criminals, to the extent that they live in everyday society, are bound by the normal limitations on human activity, shaped by the dictates of work, families, sleep, food, finances, transportation, and so forth (Canter, 1994, pp. 106-109). “They are all acting within the confines of their own knowledge and awareness ... constrained by their own experience and habits” (p. 117). Canter (chap. 5) discusses the notion of criminal maps, providing a number of examples of how environmental psychology and an understanding of offenders’ mental maps can assist in the investigation of violent crime.

Journey to Crime Research

The journey to crime literature includes numerous studies of “crime trips” related to a variety of offence types for several North American and European

39 “Crime trips,” or “journeys to crime,” are usually defined by some direct of surrogate measure of distance between offender residence and location of offence. This may or may not have been the actual journey taken by the offender who could have originated his or her travel from work, the house of a friend, or the local bar.
cities. The influence of additional variables, usually grouped into offender and offence characteristics, are also often explored. Such offender characteristics have included sex, race, age, prior criminal experience, and nature of home area; the offence variables have covered crime type, target area attributes, and perceived level of potential criminal gain (Baldwin & Bottoms, 1976; Capone & Nichols, 1975; LeBeau, 1987a; Nichols, 1980; Reppetto, 1974; Rhodes & Conly, 1981).

Results from journey to crime studies are usually reported in one of four manners: (1) mean crime trip distances; (2) medial circles; (3) mobility triangles; and (4) distance-decay functions. Studies of the first type compute the arithmetic average for the distance travelled by offenders from home to offence location. Some researchers have used the geometric mean to avoid the distortion of extreme values (LeBeau, 1987a, p. 133). Others have provided additional descriptive statistics such as the mode (Rhodes & Conly, 1981, p. 179), maximum crime trip distance (Canter & Larkin, 1993, p. 67), minimum crime trip distance (Warren, Reboussin, & Hazelwood, 1995, pp. 205-218), range (Turner, 1969), and directional information (Rengert & Wasilchick, 1985, pp. 68-74).

The major problem with the use of the mean or mode is the limited information a univariate statistic provides. The mean is also susceptible to the influence of spatial outliers and may say very little about the typical crime trip.
And since an average crime trip distance is produced from an aggregation or series of trips, typically involving several offenders, it might not actually describe any one type of offender very well.

Studies of the second sort provide their results in the form of a radial distance which defines a circle containing a certain percentage of the offences.\textsuperscript{40} For example, in a study of robbery within Boston, Reppetto (1976) found that 90% of the offences occurred within 1.5 miles of the offender's residence. Like the first approach, this method supplies only a single measure of the nature of crime journeys, says little of the typical crime trip, and expresses almost nothing about the cases that fall outside of the arbitrary radius.

Studies of the third type employ some form of mobility triangle to examine the question of crime location. Mobility triangles were first used by Burgess (1925) to describe those situations where offence location and offender residence were in different neighbourhoods; this was in contrast to neighbourhood triangles which occurred in those instances where the crime took place in the offender's home area.

\textsuperscript{40} If the circle contains one-half of the offences, the radius is equivalent to the median crime trip distance.
Subsequent developments of the mobility triangle concept used various possible combinations of crime scene, offender residence, and victim residence spatial conjunction (Amir, 1971; Normandeau, 1968). Crime journey research findings are often presented in the form of the percentage of offences that could be described by the neighbourhood triangle designation (Amir; Normandeau; Ploughman & Ould, 1990; Rand, 1986).

One difficulty with the mobility or neighbourhood triangle approach centres on the question of how the research defines the concept of “neighbourhood.” Most studies have used census tract delineations, a highly problematic assumption (see Brantingham & Brantingham, 1984, pp. 215-219). Census tracts are only rough approximations of neighbourhoods and more sophisticated concepts of mobility, routine activities, and target selection are available (e.g., Brantingham & Brantingham, 1981; Felson, 1986). Other studies have not defined the concept of neighbourhood, but rather have used the subjective interpretations of respondents (see, for example, DeFrances & Smith, 1994).

The most useful presentation of crime trip data has been the distance-decay approach, a graphical curve that shows the number of trips for several different radii (e.g., half-mile increments) from the offender’s residence (see, for example, Capone & Nichols, 1976, pp. 206-207; Rhodes & Conly, 1981, p. 179; also
Baldwin & Bottoms, 1976, chap. 3). Such formats allow for an inspection of the distance-decay function, contributing a greater level of information for further analysis and providing a fuller understanding of the nature of crime journeys.

The journey to crime literature contains several common findings. These include the following observations:

- Crimes often occur in relatively close proximity to the home of the offender (Canter, 1994, pp. 282-283; McIver, 1981, pp. 24-25; Rebscher & Rohrer, 1991, p. 242). “While criminals are mobile, they don’t seem to go very far in committing a crime. A majority of crimes appear to take place within a mile of the criminal’s residence” (McIver, p. 22). Time is seen as a commodity and almost all people act in a manner to conserve its use (Brantingham & Brantingham, 1984, p. 344; LeBeau, 1992, pp. 125-126; Rengert & Wasilchick, 1985, p. 20; Rhodes & Conly, 1981, p. 172). Such a pattern is consistent with the nearness and least-effort principles. Table 2 (see end of section) presents a summary of findings from the journey to crime research.

- Crime trips follow a distance-decay function with the number of crime occurrences decreasing with distance from the offender’s residence (Brantingham & Brantingham, 1984, pp. 344-346; Capone & Nichols,
1975; Rhodes & Conly, 1981, p. 178). This pattern is very similar to that exhibited by other forms of human movement (Jakle, Brunn, & Roseman, 1976, pp. 105-109).

- Juvenile offenders are most likely to commit their crimes within their home areas, and are usually less mobile than adult offenders (Baldwin & Bottoms, 1976, pp. 79-80; Gabor & Gottheil, 1984, p. 270; Warren et al., 1995, pp. 215, 141, 146).

- Differences in crime trip distance have consistently been found between offence types. Violent offences, for example, usually occur closer to offender residence than do property offences (Baldwin & Bottoms, 1976, pp. 79-80; Gabor & Gottheil, 1984, p. 270; LeBeau, 1987a; Rhodes & Conly, 1981, p. 169-179).

- Most cities contain high crime rate neighbourhoods, the arrangement and location of which influence the patterning of crime trips (Gabor & Gottheil, 1984, p. 270; Rhodes & Conly, 1981, pp. 171, 183-188).

It has been proposed that as an offender’s criminal career matures, journey to crime distances lengthen and size of hunting area increases (Brantingham & Brantingham, 1981, pp. 45-46; Canter & Larkin, 1993, p. 68). After the arrest of
David Berkowitz, police searching his apartment “found maps of Connecticut, New York, and New Jersey, marked and annotated in such a way that investigators took them as evidence that Berkowitz was planning to extend his killing grounds” (Time-Life Books, 1992b, p. 179).

The FBI believe that the first attack in a serial murder series is the one most likely to be closest to the offender’s home (Warren et al., 1995, p. 229). Both Barrett (1990, p. 166) and Canter (1994, pp. 95-96) suggest that the first crime of serial offenders may be spontaneous and impulsive, and observe that victim selectivity tends to decrease over time (see, for example, the discussion on changes in Jeffrey Dahmer’s murder pattern, in Ressler & Shachtman, 1992, pp. 91, 243-244). These considerations suggest the importance of a temporal dimension in the analysis of spatial crime patterns (see Kind, 1987a; LeBeau, 1992; Newton & Newton, 1985; Newton & Swoope, 1987).

In an FBI study of travel distances and offence patterns for 108 U.S. serial rapists responsible for a total of 565 offences, Warren et al. (1995, pp. 229-232) observed that the rape closest to the offender’s residence was the first in 18%, but the fifth in 24% of the cases. And a British study of 79 rapists and 299 sexual offences (Davies & Dale, 1995a, p. 11) found no significant difference in distance between first and last crime trip for prolific offenders (those with 5 or more rapes).
Noting that habitual burglars and robbers travelled longer distances, Davies and Dale (1995a, pp. 7-11, 14) suggest that for those rapists with a history of break and entry the first rape in a series might well be their fiftieth housebreaking. Any maturation in crime pattern would therefore have occurred long ago. This problem is compounded by the fact that sexual assaults are notoriously underreported, and the first known rape might actually be the offender's second or third (Davies & Dale, p. 3; Leyton, O'Grady, & Overton, 1992, Pt. 1). Such a misinterpretation happened in the Vampire Killer case where Sacramento County police believed the second murder was actually the first (Ressler & Shachtman, 1992, p. 9).

The concept of journey to crime implies a home base from which the trip is commenced, yet some offenders may not have a residence. Convicted criminals also tend to be less residentially stable than noncriminals. But fewer than 10% of the criminals Canter (1994, pp. 98-99) studied were of "no fixed abode" at the time of their arrest. Davies and Dale (1995b, p. 4) determined that 22% of those rapists for whom they had such information were itinerant. Victims in their study were confronted at their homes in 41% of the cases, and within public areas.

---

41 House (1993, pp. 68-70) examined offence venue for 61 Canadian cases of stranger sexual assault committed by 30 offenders (40% of whom were serial rapists, each responsible for an average of 2.8 crimes). He found that 61% of the crimes occurred outdoors and 39% inside (38% of which were in the victim's residence).
(including apartment building common areas) in 58% of the cases. They observed that “some rapists were obviously drawn to areas where potential victims were accessible, such as red-light districts ... The distance the offenders travelled was clearly related to the proximity of their own residence to these locations” (Davies & Dale, 1995a, p. 13).

These places of victim accessibility included nodes such as the entrances to train stations and apartment blocks, and routes used by females commuting to work, school, shopping, and entertainment areas. Since the value of these “victim hunting grounds” depended upon the activity level of females, their desirability was influenced by time of day. Distinct clusters of contact sites were noted, some associated with victim availability, others with residences of people significant to the offender (Davies & Dale, 1995a, pp. 10, 13). Ted Bundy’s FBI wanted poster alerted people to his preferred target areas – beaches, ski resorts, discotheques, and college campuses (Ressler & Shachtman, 1992, p. 64). Such finding are consistent with Brantingham and Brantingham’s (1981, 1993b) pattern theory and model of crime site selection (see below).
<table>
<thead>
<tr>
<th>Source</th>
<th>Crime</th>
<th>Location</th>
<th>Year</th>
<th>Crime Trip Distance</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aitken et al. (1994)</td>
<td>sex motivated child murders</td>
<td>Great Britain</td>
<td>1960-1991</td>
<td>91.6% &lt; 5 mi</td>
<td>&gt; 5 mi if offender travel or victim abduction indicated</td>
</tr>
<tr>
<td>Alston (1994)</td>
<td>stranger serial sexual assault</td>
<td>British Columbia</td>
<td>1977-1993</td>
<td>31.1% &lt; 0.5 km; 44.4% &lt; 1 km; 55.6% &lt; 1.5 km; 60.0% &lt; 2 km; 75.6% &lt; 3 km</td>
<td>distance to nearest offender activity node</td>
</tr>
<tr>
<td>Amir (1971)</td>
<td>rape</td>
<td>Philadelphia</td>
<td>1958-1960</td>
<td>72% within home area (5 blocks)</td>
<td>mobility triangles</td>
</tr>
<tr>
<td>Baldwin &amp; Bottoms (1976)</td>
<td>property crime</td>
<td>Sheffield</td>
<td>1966</td>
<td>47% &lt; 1 mi; 69% &lt; 2 mi</td>
<td></td>
</tr>
<tr>
<td>Baldwin &amp; Bottoms (1976)</td>
<td>breaking offence</td>
<td>Sheffield</td>
<td>1966</td>
<td>54.4% &lt; 1 mi; 74.8% &lt; 2 mi</td>
<td></td>
</tr>
<tr>
<td>Baldwin &amp; Bottoms (1976)</td>
<td>larceny offence</td>
<td>Sheffield</td>
<td>1966</td>
<td>51.9% &lt; 1 mi; 74.3% &lt; 2 mi</td>
<td></td>
</tr>
<tr>
<td>Baldwin &amp; Bottoms (1976)</td>
<td>taking &amp; driving offence</td>
<td>Sheffield</td>
<td>1966</td>
<td>45% &lt; 1 mi; 63.3% &lt; 2 mi</td>
<td></td>
</tr>
<tr>
<td>Boggs (1965)</td>
<td>homicide &amp; assault</td>
<td>St. Louis</td>
<td></td>
<td>most likely within residential area</td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>Crime</td>
<td>Location</td>
<td>Year</td>
<td>Crime Trip Distance</td>
<td>Comments</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------</td>
<td>-------------------</td>
<td>-----------</td>
<td>--------------------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Boggs (1965)</td>
<td>rape &amp; robbery</td>
<td>St. Louis</td>
<td></td>
<td>most likely within nonresidential area</td>
<td></td>
</tr>
<tr>
<td>Bullock (1955)</td>
<td>homicide</td>
<td>Houston</td>
<td>1945-1949</td>
<td>40% &lt; 1 block; 57% &lt; 0.4 mi; 74% &lt; 2 mi</td>
<td></td>
</tr>
<tr>
<td>Canter &amp; Larkin (1993)</td>
<td>serial rape</td>
<td>Greater London &amp; SE England</td>
<td>1980s</td>
<td>1.53 mi minimum crime trip distance</td>
<td>87% marauders; 13% commuters</td>
</tr>
<tr>
<td>Capone &amp; Nichols (1976)</td>
<td>robbery</td>
<td>Miami</td>
<td>1971</td>
<td>1/3 &lt; 1 mi; 1/2 &lt; 2 mi; 2/3 &lt; 3 mi</td>
<td></td>
</tr>
<tr>
<td>Capone &amp; Nichols (1976)</td>
<td>armed robbery</td>
<td>Miami</td>
<td>1971</td>
<td>26% &lt; 1 mi; 45% &lt; 2 mi; 59% &lt; 3mi</td>
<td></td>
</tr>
<tr>
<td>Capone &amp; Nichols (1976)</td>
<td>unarmed robbery</td>
<td>Miami</td>
<td>1971</td>
<td>36% &lt; 1 mi; 60% &lt; 2 mi; 75% &lt; 3mi</td>
<td></td>
</tr>
<tr>
<td>Chappell (1965)</td>
<td>burglary</td>
<td>England</td>
<td>1965</td>
<td>50%/85% &lt; 1 mi (&lt; 21/14 years)</td>
<td></td>
</tr>
<tr>
<td>Davies &amp; Dale (1995b)</td>
<td>stranger rape</td>
<td>England</td>
<td>1965-1993</td>
<td>17% &lt; 0.5 mi; 29% &lt; 1 mi; 52% &lt; 2 mi; 60% &lt; 3 mi; 69% &lt; 4 mi; 76% &lt; 5 mi</td>
<td>approach site; 72%/24% &lt; 1.8 mi (&lt;/&gt;) 26 years</td>
</tr>
<tr>
<td>DeFrances &amp; Smith (1994)</td>
<td>all offences</td>
<td>United States</td>
<td>1991</td>
<td>43% in own neighbourhood (violent crime 44.7%; murder 44.5%; rape 59.6%)</td>
<td>sample survey of state prison inmates</td>
</tr>
<tr>
<td>Source</td>
<td>Crime</td>
<td>Location</td>
<td>Year</td>
<td>Crime Trip Distance</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------</td>
<td>---------------</td>
<td>------------</td>
<td>--------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Erlanson (1946)</td>
<td>rape</td>
<td>Chicago</td>
<td>1938-1946</td>
<td>87% within home neighbourhood</td>
<td>home neighbourhood = police precinct</td>
</tr>
<tr>
<td>Farrington &amp; Lambert (1993)</td>
<td>burglary &amp; violent offences</td>
<td>Nottinghamshire</td>
<td>1991</td>
<td>69.2%/55.3% &lt; 1 mi; 80.7%/67.8% &lt; 2 mi (burglars/violent offenders)</td>
<td>younger &amp; smaller offenders lived closer</td>
</tr>
<tr>
<td>Gabor &amp; Gottheil (1984)</td>
<td>total of 10 crimes</td>
<td>Ottawa</td>
<td>1981</td>
<td>1.22 mi (70.5% in-towners)</td>
<td>out-of-towners, NFAs, &amp; n/k excluded</td>
</tr>
<tr>
<td>Gabor &amp; Gottheil (1984)</td>
<td>homicide</td>
<td>Ottawa</td>
<td>1981</td>
<td>0.54 mi (71% in-towners)</td>
<td>out-of-towners, NFAs, &amp; n/k excluded</td>
</tr>
<tr>
<td>Gabor &amp; Gottheil (1984)</td>
<td>rape &amp; indecent assault</td>
<td>Ottawa</td>
<td>1981</td>
<td>1.43 mi (90% in-towners)</td>
<td>out-of-towners, NFAs, &amp; n/k excluded</td>
</tr>
<tr>
<td>Gabor &amp; Gottheil (1984)</td>
<td>armed robbery</td>
<td>Ottawa</td>
<td>1981</td>
<td>1.22 mi (80% in-towners)</td>
<td>out-of-towners, NFAs, &amp; n/k excluded</td>
</tr>
<tr>
<td>Gabor &amp; Gottheil (1984)</td>
<td>unarmed robbery</td>
<td>Ottawa</td>
<td>1981</td>
<td>0.62 mi (55% in-towners)</td>
<td>out-of-towners, NFAs, &amp; n/k excluded</td>
</tr>
<tr>
<td>Year</td>
<td>Location</td>
<td>Crime Trip Distance</td>
<td>Source</td>
<td>Comments</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>---------------------</td>
<td>--------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>Ottawa</td>
<td>1.33 mi (90% in-towners)</td>
<td>Gabor &amp; Gottheil (1984)</td>
<td>out-of-towners, NFA, &amp; n/k excluded</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>Ottawa</td>
<td>0.35 mi (65% in-towners)</td>
<td>Gabor &amp; Gottheil (1984)</td>
<td>out-of-towners, NFA, &amp; n/k excluded</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>Ottawa</td>
<td>1.24 mi (70% in-towners)</td>
<td>Gabor &amp; Gottheil (1984)</td>
<td>out-of-towners, NFA, &amp; n/k excluded</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>Ottawa</td>
<td>1.74 mi (90% in-towners)</td>
<td>Gabor &amp; Gottheil (1984)</td>
<td>out-of-towners, NFA, &amp; n/k excluded</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>Ottawa</td>
<td>1.74 mi (35% in-towners)</td>
<td>Gabor &amp; Gottheil (1984)</td>
<td>out-of-towners, NFA, &amp; n/k excluded</td>
<td></td>
</tr>
<tr>
<td>1981</td>
<td>Ottawa</td>
<td>2.5 mi</td>
<td>San Diego</td>
<td>geometric mean; Manhattan geometry</td>
<td></td>
</tr>
<tr>
<td>1971-1975</td>
<td></td>
<td>2.5 mi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>Year</td>
<td>Crime Trip Distance</td>
<td>Location</td>
<td>Crime Type</td>
<td>Mobility Triangles</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------</td>
<td>---------------------</td>
<td>-----------------</td>
<td>-------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>LeBeau (1987a)</td>
<td>1971-1975</td>
<td>1.77 mi</td>
<td>San Diego</td>
<td>serial rape</td>
<td>48% within home census tract</td>
</tr>
<tr>
<td>LeBeau (1987a)</td>
<td>1971-1975</td>
<td>3.5 mi</td>
<td>San Diego</td>
<td>nonsexual rape</td>
<td>50% within home census tract</td>
</tr>
<tr>
<td>LeBeau (1992)</td>
<td>1971-1975</td>
<td>25.88/1.89/0.52/3.33 km</td>
<td>San Diego</td>
<td>serial rape &amp; related crime</td>
<td>mobility triangles</td>
</tr>
<tr>
<td>LeBeau (1992)</td>
<td>1971-1975</td>
<td>1.57 mi; 33% within home census tract</td>
<td>Philadelphia</td>
<td>robbery</td>
<td>61% within home census tract</td>
</tr>
<tr>
<td>Normandeau (1968)</td>
<td>1972</td>
<td>52% &lt; 1 mi</td>
<td>6 California</td>
<td>burglary</td>
<td>48% within home census tract</td>
</tr>
<tr>
<td>Pope (1980)</td>
<td>1974</td>
<td>1.34 mi</td>
<td>Akron</td>
<td>rape</td>
<td>mobility triangles</td>
</tr>
<tr>
<td>Pyle (1974)</td>
<td>1976</td>
<td>crime against the person</td>
<td>Cleveland</td>
<td>48% within home census tract</td>
<td>mobility triangles</td>
</tr>
<tr>
<td>Pyle (1976)</td>
<td>1968-1975</td>
<td>property crime</td>
<td>Philadelphia</td>
<td>30.7% within home census tract</td>
<td>mobility triangles</td>
</tr>
<tr>
<td>Rand (1986)</td>
<td>1968-1975</td>
<td>total of 8 crimes</td>
<td>Philadelphia</td>
<td>juvenile offenders; mobility triangles</td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>Crime</td>
<td>Location</td>
<td>Year</td>
<td>Crime Trip Distance</td>
<td>Comments</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
<td>--------------</td>
<td>-------------</td>
<td>----------------------------------------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>Rand (1986)</td>
<td>criminal homicide</td>
<td>Philadelphia</td>
<td>1968-1975</td>
<td>53.13% within home census tract</td>
<td>juvenile offenders; mobility triangles</td>
</tr>
<tr>
<td>Rand (1986)</td>
<td>rape</td>
<td>Philadelphia</td>
<td>1968-1975</td>
<td>53.13% within home census tract</td>
<td>juvenile offenders; mobility triangles</td>
</tr>
<tr>
<td>Rand (1986)</td>
<td>robbery</td>
<td>Philadelphia</td>
<td>1968-1975</td>
<td>31.87% within home census tract</td>
<td>juvenile offenders; mobility triangles</td>
</tr>
<tr>
<td>Rand (1986)</td>
<td>aggravated assault</td>
<td>Philadelphia</td>
<td>1968-1975</td>
<td>38.60% within home census tract</td>
<td>juvenile offenders; mobility triangles</td>
</tr>
<tr>
<td>Rand (1986)</td>
<td>burglary</td>
<td>Philadelphia</td>
<td>1968-1975</td>
<td>42.02% within home census tract</td>
<td>juvenile offenders; mobility triangles</td>
</tr>
<tr>
<td>Rand (1986)</td>
<td>larceny</td>
<td>Philadelphia</td>
<td>1968-1975</td>
<td>14.77% within home census tract</td>
<td>juvenile offenders; mobility triangles</td>
</tr>
<tr>
<td>Rand (1986)</td>
<td>vehicle theft</td>
<td>Philadelphia</td>
<td>1968-1975</td>
<td>23.05% within home census tract</td>
<td>juvenile offenders; mobility triangles</td>
</tr>
<tr>
<td>Source</td>
<td>Crime</td>
<td>Location</td>
<td>Year</td>
<td>Crime Trip Distance</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------------</td>
<td>------------------</td>
<td>---------</td>
<td>------------------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Rand (1986)</td>
<td>simple assault</td>
<td>Philadelphia</td>
<td>1968-1975</td>
<td>39.41% within home census tract</td>
<td>juvenile offenders; mobility triangles</td>
</tr>
<tr>
<td>Reiss (1967)</td>
<td>Part I &amp; Part II Offences</td>
<td>Seattle</td>
<td>1965</td>
<td>not likely to be in home census tract</td>
<td></td>
</tr>
<tr>
<td>Rengert &amp; Wasilchick (1985)</td>
<td>suburban burglary</td>
<td>Delaware Co.</td>
<td></td>
<td>52% &lt; 5 mi; 71% unemployed; 40% employed</td>
<td>work &amp; recreation site directional biases</td>
</tr>
<tr>
<td>Reppetto (1976)</td>
<td>robbery</td>
<td>Boston</td>
<td></td>
<td>0.6 mi; 90% &lt; 1.5 mi</td>
<td></td>
</tr>
<tr>
<td>Reppetto (1976)</td>
<td>residential burglary</td>
<td>Boston</td>
<td></td>
<td>0.5 mi; 93% &lt; 1.5 mi</td>
<td></td>
</tr>
<tr>
<td>Rhodes &amp; Conly (1981)</td>
<td>rape</td>
<td>Washington, DC</td>
<td>1974</td>
<td>1.15 mi; 0.73 mi median; 62% &lt; 1 mi</td>
<td>wheel distance</td>
</tr>
<tr>
<td>Rhodes &amp; Conly (1981)</td>
<td>robbery</td>
<td>Washington, DC</td>
<td>1974</td>
<td>2.10 mi; 1.62 mi median; 37% &lt; 1 mi</td>
<td>wheel distance</td>
</tr>
<tr>
<td>Rhodes &amp; Conly (1981)</td>
<td>burglary</td>
<td>Washington, DC</td>
<td>1974</td>
<td>1.62 mi; 1.20 mi median; 47% &lt; 1 mi</td>
<td>wheel distance</td>
</tr>
<tr>
<td>Source</td>
<td>Crime</td>
<td>Location</td>
<td>Year</td>
<td>Crime Trip Distance</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------</td>
<td>----------------</td>
<td>------</td>
<td>----------------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Sapp et al. (1993)</td>
<td>serial arson</td>
<td>United States</td>
<td></td>
<td>27.1% &lt; 0.5 mi; 56.8% &lt; 1 mi; 77.1% &lt; 2 mi; 81.2% &lt; 5 mi; 86.6% &lt; 10 mi</td>
<td>95.1% acquainted with crime area; 60.8% walked</td>
</tr>
<tr>
<td>Suttles (1968)</td>
<td></td>
<td>Chicago</td>
<td></td>
<td>65% within home area</td>
<td>juvenile offenders</td>
</tr>
<tr>
<td>Topalin (1992)</td>
<td>serial rape</td>
<td>London area</td>
<td>1980s</td>
<td>2.81 mi; 20% in or close to home</td>
<td>0-27 mi range; first convicted offence</td>
</tr>
<tr>
<td>Turner (1969)</td>
<td>assault &amp; vandalism</td>
<td>Philadelphia</td>
<td>1960</td>
<td>0.4 mi; 75% &lt; 1 mi; 87% &lt; 2 mi</td>
<td>0-23 mi range; juvenile offenders</td>
</tr>
<tr>
<td>Waller &amp; Okihiro (1978)</td>
<td>burglary</td>
<td>Toronto</td>
<td></td>
<td>50% &lt; 0.5 mi</td>
<td></td>
</tr>
<tr>
<td>Warren et al. (1995)</td>
<td>serial rape</td>
<td>United States</td>
<td></td>
<td>3.14 mi; 1.66/4.93 mi average closest/furthest (local offenders, travel &lt; 20 mi)</td>
<td>rituals, restraints, burglary, all indicate further travel</td>
</tr>
<tr>
<td>White (1932)</td>
<td>violent crime</td>
<td>Indianapolis</td>
<td>1930</td>
<td>0.85 mi</td>
<td></td>
</tr>
<tr>
<td>White (1932)</td>
<td>property crime</td>
<td>Indianapolis</td>
<td>1930</td>
<td>1.72 mi</td>
<td></td>
</tr>
<tr>
<td>White (1932)</td>
<td>manslaughter</td>
<td>Indianapolis</td>
<td>1930</td>
<td>0.11 mi</td>
<td></td>
</tr>
<tr>
<td>White (1932)</td>
<td>rape</td>
<td>Indianapolis</td>
<td>1930</td>
<td>1.52 mi</td>
<td></td>
</tr>
<tr>
<td>Source</td>
<td>Crime</td>
<td>Location</td>
<td>Year</td>
<td>Crime Trip Distance</td>
<td>Comments</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------</td>
<td>--------------</td>
<td>------</td>
<td>----------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>White (1932)</td>
<td>robbery</td>
<td>Indianapolis</td>
<td>1930</td>
<td>2.14 mi</td>
<td></td>
</tr>
<tr>
<td>White (1932)</td>
<td>assault</td>
<td>Indianapolis</td>
<td>1930</td>
<td>0.91 mi</td>
<td></td>
</tr>
<tr>
<td>White (1932)</td>
<td>burglary</td>
<td>Indianapolis</td>
<td>1930</td>
<td>1.76 mi</td>
<td></td>
</tr>
<tr>
<td>White (1932)</td>
<td>embezzlement</td>
<td>Indianapolis</td>
<td>1930</td>
<td>2.79 mi</td>
<td></td>
</tr>
<tr>
<td>White (1932)</td>
<td>auto theft</td>
<td>Indianapolis</td>
<td>1930</td>
<td>3.43 mi</td>
<td></td>
</tr>
<tr>
<td>White (1932)</td>
<td>larceny</td>
<td>Indianapolis</td>
<td>1930</td>
<td>1.53/1.42 mi (grand/petty larceny)</td>
<td></td>
</tr>
<tr>
<td>Wolfgang (1958)</td>
<td>homicide</td>
<td>Philadelphia</td>
<td></td>
<td></td>
<td>50%+ within home of offender or victim</td>
</tr>
</tbody>
</table>

Table 2. Journey to Crime Research.\(^42\)

\(^42\) NFA means “no fixed address,” and n/k means “not known.” Unless otherwise specified, the figures in the Crime Trip Distance column refer to mean journey to crime distances.”

139
Environmental Criminology

"Environmental criminologists set out to use the geographic imagination in concert with the sociological imagination to describe, understand, and control criminal events" (Brantingham & Brantingham, 1981c, p. 21). This concern with the environment, and a change in focus from the offender to the criminal event, distinguish environmental criminology from the earlier ecological work of the Chicago School. Traditionally, the main interest of criminological positivism has been the offender, and much effort has gone into studying offender backgrounds, peer influences, criminal careers, and deterrence. This focus has tended to ignore the other components of crime – the victim, the criminal law, and the crime setting (Jeffery, 1977). The crime setting or place, the "where and when" of the criminal act, makes up what Brantingham and Brantingham (pp. 7-8, 19) call the fourth dimension of crime, the primary concern of environmental criminology.

Research in this area has taken a broad approach by including operational, perceptual, behavioural, physical, social, psychological, legal, cultural, and geographic settings in its analyses (Brantingham & Brantingham, 1984, pp. 332-336). These works range from micro to meso to macrospatial levels of analytic focus (Brantingham & Brantingham, 1981c, p. 21). One of environmental criminology's major interests, the study of the dimensions of crime at the
microspatial level, has led to useful findings in the area of crime prevention (see, for example, R. V. Clarke, 1992, pp. 9-10).

Other projects have included the analyses of crime trips (Rhodes & Conly, 1981), efforts to understand target and victim selections through opportunities for crime (Brantingham & Brantingham, 1981c), crime prevention initiatives, notably crime prevention through environmental design (CPTED) (Jeffery, 1977; Taylor, Gottfredson, & Brower, 1980; Wood, 1981), studies of shopping mall crime (Brantingham, Brantingham, & Wong, 1990), proposals for rapid transit security (Brantingham, Brantingham, & Wong, 1991; Felson, 1989), the analysis of patterns of fugitive migration (Rossmo & Routledge, 1990), and other works (see R. V. Clarke, 1992).

This dissertation has approached the research of the target patterns and hunting behaviour of serial murderers through the further development of the ideas and principles found in the geography of crime and environmental criminology. At a microspatial level such a study must be aware of the dimensions of the offender, the victim, the crime, and the environment.
The Brantingham and Brantingham Model of Crime Site Selection

As chaotic as crime may appear to be, there is often a rationality influencing the geography of its occurrence and some semblance of structure underlying its spatial distribution. Using an environmental criminology perspective, Brantingham and Brantingham (1981, 1984, chap. 12) present a series of propositions that provide insight into the processes underlying the geometry of crime. Their model of crime site selection suggests that crimes are most likely to occur in those areas where the awareness space of the offender intersects with perceived suitable targets (desirable targets with an acceptable risk level attached to them).

These ideas suggest that most offenders do not choose their crime sites randomly. While any given victim may be selected by chance, the process of such random selection is spatially structured whether the offender realizes it or not. The psychological profile prepared by the FBI in the case of the Atlanta Child Murders proposed the following:

Your offender is familiar with the crime-scene areas he is in, or has resided in this area. In addition, his past or present occupation caused him to drive through these areas on different occasions ... the sites of the deceased are not random or “chance” disposal areas. He realizes these areas are remote and not frequently traveled by others. (Linedecker, 1991, p. 70)
After the arrest of Wayne Williams police were able to determine that he had, in the past, done free-lance photography assignments near several of the victim's burial sites.

Such a spatial selection process is consistent with the routine activities approach and its emphasis on the relevance of regular and routine victim behaviours for an understanding of crime patterns (R. V. Clarke, 1992, p. 10; Clarke & Felson, 1993a, pp. 8-11). Cohen and Felson (1979) suggest that:

Structural changes in routine activity patterns can influence crime rates by affecting the convergence in space and time of the three minimal elements of direct-contact predatory violation: 1) motivated offenders, 2) suitable targets, and 3) the absence of capable guardians against a violation. (p. 589)

Brantingham and Brantingham use these concepts of opportunity, motivation, mobility, and perception in the development of the following model of crime site geography:

---

43 Ford (1990) specifically stresses the investigative importance of identifying "routine victim activities and expected behaviors related to contact with and risk of victimization by a serial predator" (p. 116).
(1) Individuals exist who are motivated to commit specific offenses.

(a) The sources of motivation are diverse. Different etiological models or theories may appropriately be invoked to explain the motivation of different individuals or groups.

(b) The strength of such motivation varies.

(c) The character of such motivation varies from affective to instrumental.

(2) Given the motivation of an individual to commit an offense, the actual commission of an offense is the end result of a multistaged decision process which seeks out and identifies, within the general environment, a target or victim positioned in time and space.

(a) In the case of high affect motivation, the decision process will probably involve a minimal number of stages.

(b) In the case of high instrumental motivation, the decision process locating a target or victim may include many stages and much careful searching.

(3) The environment emits many signals, or cues, about its physical, spatial, cultural, legal, and psychological characteristics.

(a) These cues can vary from generalized to detailed.

(4) An individual who is motivated to commit a crime uses cues (either learned through experience or learned through social transmission) from the environment to locate and identify targets or victims.

(5) As experiential knowledge grows, an individual who is motivated to commit a crime learns which individual cues, clusters of cues, and
sequences of cues are associated with “good” victims or targets. These cues, cue clusters, and cue sequences can be considered a template which is used in victim or target selection. Potential victims or targets are compared to the template and either rejected or accepted depending on the congruence.

(a) The process of template construction and the search process may be consciously conducted, or these processes may occur in an unconscious, cybernetic fashion so that the individual cannot articulate how they are done.

(6) Once the template is established, it becomes relatively fixed and influences future search behavior, thereby becoming self-reinforcing.

(7) Because of the multiplicity of targets and victims, many potential crime selection templates could be constructed. But because the spatial and temporal distribution of offenders, targets, and victims is not regular, but clustered or patterned, and because human environmental perception has some universal properties, individual templates have similarities which can be identified. (1981, pp. 28-29)

Targets are selected from an offender’s awareness space and assessed against the criteria of suitability (gain or profit) and risk (probability of being observed or apprehended). These targets are scanned for certain cues (visibility, unusualness, symbolism) which are evaluated in terms of fit to the individual’s template. From the perspective of the offender rational choices are then made and specific targets chosen for victimization. Such a selection process is consistent
with the concept of an offender operating within his or her "comfort zone" (Canter, 1994, p. 188; Keppel, 1989, pp. 65-66).

A person's awareness space forms part of his or her mental map and is built primarily, but not exclusively, from the spatial experiences of the individual. An awareness space is derived from, amongst other sources, an activity space, the latter being composed of various activity sites (residence, workplace, social activity locations, etc.) and the connecting network of travel and commuting routes. Well-known locations (landmarks, tourist sites, important buildings) may also become part of a person's awareness space without actually being a component of their activity space.

Brantingham and Brantingham propose a model built on a dynamic process of target selection, with crimes occurring in those areas where suitable targets overlap the offender's awareness space (see Figure 1). Offenders may then search outward from these areas, the search behaviour following some form of distance-decay function (Brantingham & Brantingham, 1981, pp. 30-33, 1984, pp. 344-346; Rhodes & Conly, 1981, pp. 177-179). Search pattern probabilities can often be
Figure 1. Crime Site Search Geography.
modeled by a Pareto function, starting from the sites and routes that compose the activity space and then decreasing as distance away from the activity space increases.

There is usually a "buffer zone," however, centred around the criminal's residence, comparable to what Newton and Swoope (1987) term the coal-sack effect. Within this zone, targets are viewed as less desirable because of the perceived level of risk associated with operating too close to home. For the offender, this area represents an optimized balance between the maximization of opportunity and the minimization of risk (Canter, 1994, pp. 99, 105, 117). Figure 2 shows an example, derived from a serial rape case of such a buffered distance-decay function.

When Canter and Larkin (1993, pp. 64, 67-68) regressed maximum distance from crime site to home against maximum distance between crime sites for a group

\[ y = k/x^b \]

44 The Pareto function, named after the Italian economist, is suitable for fitting data that have a disproportionate number of cases close to the origin, making it appropriate for modelling distance-decay processes (Brantingham & Brantingham, 1984, pp. 237-238). It takes the general form: \( y = k/x^b \).

45 Figure 2 displays the fourth-order polynomial trend line fitted \((R^2=0.730)\) to 79 crime trip distances for John Horace Oughton, the Vancouver Paperbag Rapist (Alston, 1994; see also Eastham, 1989).
Figure 2. Distance Decay Function.
of serial rapists in England, they found a regression equation constant equivalent to 0.61 miles (see Equation 5, above). This was the “safety zone” within which the sexual offenders were less likely to strike. For affective-motivated crimes the buffer zone takes on less importance, as can be demonstrated from the fact that most domestic homicides occur within the residence.

While the Brantingham and Brantingham model provides a series of ideas for understanding the site selection of certain crimes, problems exist in its testing. These difficulties relate primarily to the task of defining and outlining the awareness space of the offender. By including all present and past residences, schools, workplaces, social activity locations, possible travel routes, and sites known to, but never visited by, the offender, an awareness space can literally encompass almost an entire city – hardly an effective method of geographic discrimination. An attempt to predict activity sites from crime locations could well be a tautological exercise.

Some parts of the awareness space have more importance than others. The activity space of the offender, a subset of the awareness space, only contains those locations visited and routes travelled by the offender on a regular, current basis. The anchor point (usually the residence) is the base out of which the offender lives and operates, a location to which he or she returns at regular intervals.
The Brantingham and Brantingham model was used in this research as a heuristic device for understanding underlying criminal target search processes. It is the perspective of this model that has informed the effort to predict offender anchor point location from crime site geography. Data were collected and examined for two specific locations in the serial murderer’s activity space: (1) residence; and (2) workplace. In addition to their importance in outlining the spatial activities of the offender, knowledge of these two places is of importance to police during a criminal investigation.

Crime Site Geography and Target Patterns

Hunting Grounds

Norris (1988, p. 25) observes that certain serial killers stake out territories where vulnerable victims are likely to be found, preferring such locations as parking lots, dark city streets, university campuses, school playgrounds, rural roads leading from schools, and so forth. These places act as “fishing holes,” attractive because of their potential for containing desirable targets.

A hunter goes where there is game.... Selection of a hunting territory is the first prerequisite for a successful kill. A slayer’s choice of stalking grounds may be determined by a private fantasy of vision, but it must include the
basic elements of reasonable access, a supply of ready victims, and a decent prospect for evading capture.... In short, the ideal hunting ground depends upon a given killer's personality and needs. (Newton, 1992, p. 64)

Canter suggests that victim selection is hierarchical. While victim preference might first delineate the offender's hunting ground, any specific victim is subsequently selected from within the chosen target area.

Attacks outdoors seem often to involve the preselection of an area by the offender with which he is familiar, rather than the preselection or targeting of particular victims. These offenders attack where they are comfortable and in surrounding which are known to them and where they may be confident of effecting escape. The victim is then selected by the circumstances in which she becomes available to the attacker and vulnerable to the attack. (Canter, 1994, p. 188)

LeBeau suggests that type of hunting ground and differences in spatial behaviour can be important for discriminating between serial and nonserial rapists. For example, he found that serial rapists overwhelmingly struck in areas characterized as small household, single and multiple family dwelling units, and inhabited by elderly and young renters (1985, pp. 394-397). And Canter (1994, pp. 117-120) noted consistency in offence venue (inside vs. outside) for serial rapists. Inside rapes indicated planning and suggested an offender with a previous
criminal history, most probably break and entry (see also Jackson et al., 1994, pp. 17-18). Outside rapes were more likely to be spontaneous and opportunistic.

_Target Backcloth_

The Brantingham and Brantingham model suggests that the structure of the target or victim backcloth is important for an understanding of the geometric arrangement of crime sites (see Brantingham & Brantingham, 1993b, for a discussion of backcloths and pattern theory). The target backcloth is equivalent to the spatial opportunity structure. It is configured by both geographic and temporal distributions of “suitable” (as seen from the offender’s perspective) crime targets or victims across the physical landscape. The availability of such targets might vary significantly according to neighbourhood, area, or even city, and can also be influenced by time, day of week, and season (Brantingham & Brantingham, 1984, pp. 104-106, 158, 361-363).

Since victim location and availability plays a key role in the determination of where offences occur, nonuniform or “patchy” target distributions can distort the spatial pattern of crime sites. Victim selections that are nonrandom, or based on specific and rare traits, will require more searching on the part of the offender.

For example, if an arsonist prefers to select warehouses as targets, their availability and distribution, geographically determined by city zoning bylaws, will have a strong influence on where the crimes occur. If the arsonist has no preferences then the target backcloth will probably be more uniform as houses and buildings abound, at least in urban areas. The target sites of a predator who seeks out prostitutes will be determined primarily by the locations of “hooker strolls,” while the attack sites of an offender who is less specific could well be found anywhere.

A uniform victim spatial distribution means that the locations of the crimes will be primarily influenced by the offender’s activity space; otherwise, crime geography is more closely related to the target backcloth. In the extreme cases of an arsonist for hire or a contract killer, victim location totally determines crime site. The consideration of victim characteristics thus plays an important role in the development of an accurate geographic profile.

The target backcloth is influenced by both the natural and built physical environments as these affect where people live. Housing development is determined by such factors as physical topography, highway networks, national boundaries, city limits, land use, and zoning regulations. The Werewolf Rapist,
Jose Rodrigues, lived in Bexhill on the south coast of Britain during his series of 16 sexual assaults. With no potential victims situated in the English Channel to the south, he was forced to confine his attacks to locations north of his residence, which resulted in a distorted target pattern. In may be possible to compensate for such problems through the appropriate topological transformation of the physical space within and surrounding the offender’s hunting area.

Crime Locations

There may be several locations involved in a case of serial murder, each with a slightly different geographic meaning (Newton & Swoope, 1987; Ressler & Shachtman, 1992, p. 101): (1) victim encounter locations; (2) points of first attack; (3) murder scenes; (4) body dump sites; and (5) vehicle or property drop sites. In many cases, some of these locations could be the same (e.g., the body dump site may also be the murder scene). The fact that a crime may involve several different sites has been recognized in studies on rape. Amir (1971, p. 137) conceptualized a rape incident as comprising the initial meeting place, the crime scene, and the after scene. LeBeau (1987c, pp. 313, 316-317) proposed a five
category classification based on a combination of Amir’s original scene types, the offender’s residence, and the victim’s residence.

The number of different crime scene types is a surrogate measure of mobility. In a San Diego study, LeBeau (1987c, p. 320) found travel by the offender with the victim to average 1.50 miles (based on 218 cases), and the two scene rape to be the most common. An examination of 11 cases of chronic serial rapists, responsible for a total of 89 offences (mean = 8.1) from 1971 to 1975, showed a journey to crime range of 0.30 miles to 30.0 miles (mean = 6.9 miles), and a mean distance between crime sites range of 0.12 miles to 0.85 miles, with an unweighted average of 0.37 miles (pp. 324-325).

While all of the crime scene types are important in the construction of a geographic profile of an offender, their locations, particularly in homicide cases, are not always known to investigating police officers.46 Prior to the apprehension

46 LeBeau (1987c, pp. 311-313, 319-326) suggests that rape cases are more likely to be solved in those instances where the offender’s modus operandi provides an opportunity for the victim to obtain greater amounts of information concerning the offender. Method of approach and the use of multiple crime scenes affect the amount of time that the victim spends with the rapist, influencing the likelihood of offender arrest. Unfortunately, victim information is rare in serial murder cases, depriving investigators of important data.
of the offender, these places can only be determined through evidence recovery or by witness statements. In a typical unsolved homicide, the police know the body dump site (which may or may not be the murder scene), and the place where the victim was last seen. And in some circumstances, they may only know one of these locations.

Nor does a given type of crime site have the same degree of relevance for all cases. If target selection is specific, as in a series of prostitute killings, then the encounter locations will be restricted, influenced more by the victim backcloth (e.g., where the red-light district is located) than by the offender's regular activity space. And sometimes the actual murder scene is unknown (Ressler & Shachtman, 1992, p. 101). But the police should be aware of the location of the dump site, providing, at least, that the victim's remains have been discovered. Since bodies can be disposed of in a multitude of locations, dump sites are relatively unrestricted and might well be the most significant type of location for an understanding of the offender's spatial behaviour47 (see Newton & Swoope, 1987; 157

47 Keppel (1989) suggests that "the discovery of a multiple body recovery site where victims have been deposited at different times should alert authorities that they are probably faced with a serial murder investigation" (p. 66).
Rossmo, 1993c, pp. 7-8). As noted below, details of these sites may also provide insight into the offender's psychology.

Offender Type

Psychological profiling can assist in determining the relationship between a suspect's routine activities and his or her target patterns. The FBI dichotomize repetitive sexual killers into organized and disorganized categories, basing their division on the personality type of the murderer and the kind of crime scene left behind after the act (Ressler et al., 1988, chap. 8). These groups are alternatively labelled organized nonsocial and disorganized asocial offenders. FBI research suggests that organized offenders comprise 48% of the murderer

---

48 A profile will indirectly infer organized or disorganized personality types from evidence and signs left by the offender at the crime scene (Crime scene and profile characteristics of organized and disorganized murderers, 1985). “Profilers pay particular attention to the manner in which a person was killed, the kind of weapon that was used ... If the killer brought along his own weapon, it points to a stalker, someone fairly well organized, even cunning, who came from another part of town and probably drove a car. If the killer used whatever weapon was available – a knife from the kitchen or a lamp cord – it points to a more impulsive act, a more disorganized personality. It also means that the person probably came on foot and lives nearby” (Porter, 1983, p. 47).
population (both sexual and nonsexual), disorganized offenders 33%, mixed offenders 14%, and unknown cases 5% (Classifying sexual homicide crime scenes, 1985, p. 16).49

Organized offenders will usually plan their crimes, employ restraints, and attack strangers (Barrett, 1990, pp. 74-79). Most of the time they have access to a serviceable vehicle and are willing to travel great distances. Organized offenders will be more likely to expand the boundaries of their awareness space and hunt in areas located further from home. They are usually mobile murderers, often transporting their victims to the murder site and then hiding their bodies (Ressler & Shachtman, 1992, chap. 6). In research on British child sexual murderers, Aitken et al. (1994, p. 33) found that evidence of travel or victim abduction was indicative of journey to crime distances greater than 5 miles. Organized murderers follow their crimes in the news and may move or change jobs to avoid apprehension (Ressler et al., pp. 121-124).

49 By comparison, the FBI study of 36 sexual murderers classified 62% as organized, 25% as disorganized, and 13% as mixed; or, alternatively, 44% very organized, 19% organized, 6% mixed, 14% disorganized, and 17% very disorganized (Ressler, 1989).
By comparison, disorganized offenders may know their victims. They act spontaneously, and tend to live or work within walking distance of their crime sites. They usually reside with their parents or in a small apartment. Disorganized killers will murder their victims at or near the encounter site, and will probably leave the body in plain view at the murder scene. They often choose crime sites from familiar areas, and tend to strike close to the nodes and routes of their activity space. Additionally, the awareness space of the disorganized criminal is likely to be smaller and less complex than that of the organized offender. Disorganized offenders are not concerned about the media, and are unlikely to significantly change their life style to avoid apprehension.

Method of Victim Disposal

While all the elements in a crime are important for an understanding of the offender’s psychology, the manner and location of the victim’s disposal (which influences if and when the body is found) may be of particular significance (Barrett, 1990):

The method of handling and leaving the victim’s body will also offer insight into the victim’s relationship to the killer. A victim left clothed or in an area allowing easy discovery suggest that she was “loved” by the killer. A
well treated, and easily found victim may also signify a killer who has a religious upbringing and who does not feel a rage directed at the victim or at society.

A victim who is left in a remote area with no care taken to bury the body suggests that the killer had little regard for her. Once she served his needs he only sought to dispose of her to avoid detection. It also suggests that the killer admits that he will continue to kill and that he hopes to deter police recognition of his activity. Victims left in a public location, dismembered or mutilated are intended to shock both the community and the intended target. (p. 167)

The method of body disposal can also be a function of criminal experience and concerns regarding scientific evidence. The forensic-conscious murderer may perceive several benefits in transporting the victim’s body from the murder scene since that is the site where the most physical evidence is usually found (Ressler & Shachtman, 1992, p. 101).

The more successful serial killers transport their victims from the scene of the murder to a remote site or makeshift grave. The police may never locate the body and thus never determine that a homicide has occurred. Even if the bodies of the victims do eventually turn up at a dump site, most of the potentially revealing forensic evidence remains in the killer’s house or car, where the victim was slain – but without a suspect, the police cannot find these places to search. Moreover any trace evidence ... left on the
discarded body tends to erode as the corpse is exposed to rain, wind, heat, and snow. (Fox & Levin, 1994, pp. 30-31)

Homicide detectives consider such a case the hardest type of murder to solve, stripped as it is of chronology and physical evidence. “A dump job, in ... [a] park or in an alley, in a vacant house or a car trunk, offers nothing. It stands mute to the relationship between the killer, the victim and the scene itself” (Simon, 1991, p. 78). The crime scenes of prolific killer Ted Bundy were rarely discovered because of his practice of transporting victims. But in Tallahassee he attacked and left victims inside a sorority house which made it possible for Florida authorities to locate incriminating physical evidence (Cleary & Rettig, 1994, p. 7; Flowers, 1993, p. 306).

Ressler et al. (1988, p. 62) report that 27% of the time (32 out of 118 cases) the sexual murderers in their study admitted returning to the crime scene50 (though they did not specify which of the various different types of crime sites the offenders returned to). Some killers moved their victims’ remains. And some just kept the bodies (or parts thereof) with them, in their homes (pp. 60-61). Location

50 David Berkowitz admitted that returning to the scenes of his former shootings was an erotic experience; Ted Bundy revisited the sites of his victims’ remains to sexually assault their body parts (Ressler & Shachtman, 1992, pp. 63-64, 68-69).

162
and method of body disposal appear to be important components of the fantasies of many of these criminals.

Learning and Displacement

It is important to be aware of both internal and external influences on the offender’s hunting process. Serial offenders can gain knowledge with each new crime and they often learn from their experiences (Warren et al., 1995, pp. 232-233). Media disclosures and certain investigative strategies, particularly patrol saturation tactics, can create spatial displacement, altering the geographic behaviour of the offender to the point that apprehension can be hindered or delayed (Gabor, 1978, p. 101; Reppetto, 1976, p. 177).

After the media reported that fibre evidence was being recovered from victims’ bodies during the investigation of the Atlanta Child Murders, Wayne Williams changed his dumping grounds from remote roads and wooded areas to

51 Because of victim backcloth influences, the other forms of displacement (target, temporal, tactical, and functional) may also alter target patterns. Davies & Dale (1995b, p. 15) found evidence for spatial, temporal, and tactical displacement in their study of British serial rapists.
local rivers (Glover & Witham, 1989, p. 8). By disposing of unclothed bodies in this fashion he hoped that any physical evidence would be washed off by the water (Keppel & Birnes, 1995, pp. 116-126). Since the geography of Atlanta’s rivers is markedly different from that of its roads and woods, this change in modus operandi led to a shift in the geographic pattern of the crime sites (see Dettlinger & Prugh, 1983, pp. 93-95). And when the New York papers wondered if the Son of Sam would continue his pattern and strike in each of the City’s boroughs, David Berkowitz responded accordingly (Ressler & Shachtman, 1992, p. 70).

Geography and Crime Investigation

From a detective’s point of view, no crime scene is better than a body in a house.... a body in the street offers less.... Not only are the opportunities for recovering physical evidence fewer, but the spatial relationship between the killer, the victim and the scene is obscured.... [But] even a body in an alley leaves a detective with questions: What was the dead man doing in that alley? Where did he come from? Who was he with? (Simon, 1991, pp. 76-78)

One of the focuses of any police investigation is the crime scene and its evidentiary contents. What is often overlooked, however, is a geographic perspective on the actions preceding the offence, the spatial behaviour that led up
to the crime scene. For any violent crime to occur there must have been an intersection of victim and offender in both time and place (Felson, 1994a, 1994b, pp. 30-31; see also Canter, 1994, pp. 186-187). How did this happen? What were the antecedents? What do the spatial elements of the crime tell us about the offender and his or her actions? What are the hunting patterns of predatory offenders?

While police officers are intuitively aware of the influence of place on crime, they are often unaware of the many different ways in which geography can assist their work, of how looking beyond the crime scene tape can provide additional clues (see Dettlinger & Prugh, 1983, chap. 6; Herbert, 1994). In spite of this general lack of utilization, however, there are some specific examples of the application of geographic principles by the police in the effort to investigate crime and apprehend offenders.

Senior Superintendent Arvind Verma describes how the Indian Police Service in the Bihar province have used a form of geographical analysis in the investigation of certain kinds of offences (Rossmo, 1995b). Dacoities are a type of violent robbery dating back to 500 BC, involving gangs of five or more offenders. As these crimes customarily occur in the countryside, the lack of rural anonymity requires the dacoity gang to attack villages other than their own, and then only
during those nights when the moon is new. There is usually little or no artificial lighting in rural India, and the lunar dark phase is a period of almost complete blackness which provides cover for such criminal activities.

Upon being notified of a dacoity, the police will first determine the length of time between the occurrence of the crime and first light. Knowing the average speed that a person can travel cross-country on foot then allows the police to calculate a distance radius, centred on the crime site, which determines a circle within which the home village of the dacoity members most probably lies. There are few vehicles and if the criminals are not home by daylight, they run the risk of being observed by farmers who begin to work the fields at dawn.

The villages located within this circle can then be narrowed down by eliminating those of the same caste as the victim village, as "brother" is not likely to harm "brother." And, if a sufficiently detailed description of the criminals can be obtained, dress, modus operandi, and other details can help determine the caste of the gang, allowing the police to concentrate further on the appropriate villages. Patrols can then speed to these places and attempt to intercept the dacoity members, or to proceed to investigate known criminal offenders residing in the area.
Police dog handlers have noted patterns in the escape routes and movements of offenders fleeing from the scenes of their crimes (Eden, 1985, 1994). This predictability in the behaviour of those under stress has been observed in both actual trackings of suspects and in experimental reenactments using police dog quarries. Fleeing offenders tend to turn to the left if they are right-handed, move to the right upon encountering obstacles, discard evidentiary items to their right, and stay near the outside walls when hiding in large buildings (Eden, 1985, p. 100). Different patterns are found when conducting passive tracks for missing persons. Lost subjects tend to bear to the right in their wanderings, and men seem to favour downhill paths while women and children choose uphill routes (Eden, 1985, pp. 100-101).

A study of bank robbery escape patterns in the Federal Republic of Germany, conducted by the national police science research institute (Bundeskriminalamt), produced several findings with implications for police response strategies (Büchler & Leineweber, 1991; see also Leineweber & Büchler, 1991). The research determined that most offenders (84.8%) planned their escapes, routes, and vehicle use. Professional criminals also assessed bank location, distance from nearest police station, escape possibilities, and close-by
hiding places. Bank robbers tended to keep to this plan whenever possible, even if problems developed (which often did).

Approximately 71% of the offenders were successful in their escape, most employing a two-stage flight process by switching vehicles or transportation modes between phases. The first stage generally lasted under 5 minutes, terminating within 2 kilometres of the bank in urban areas, and within 5 kilometres in rural areas. During the first stage robbers usually fled on foot (41.3%) or by car (44.4%). Escape during the second phase was most often by vehicle, or, less commonly, on foot or by public transportation. Offenders with accomplices tended to use stolen cars, stay together, and avoid escape on foot. If the crime occurred in an urban area the robbers stayed nearby, while in rural areas they tried to get as far away as possible. Overall, 20% of the criminals studied remained in the vicinity of the bank. The most common destination was a residence, usually that of the offender.

A common police response in Germany to bank robbery is the formation of a circular blockade (*Ringalarmfahndung*). This is an immediate and precise deployment of police personnel in an effort to apprehend the offenders by circumscribing the target area. The operation involves both dynamic (patrol) and static (control point) tactics. The study determined, however, that it took an
average of 26.7 minutes to form a blockade, a length of time that undoubtedly contributed to its low success rate (15% to 20%).

The research findings led to a series of recommendations for the improvement of operational response to bank robbery. It was suggested that circular blockades should be established at a distance of no greater than 5 kilometres from urban crime scenes. Police search maps should be simple, accessible, and easy to use. In order to improve response time, tactical management should occur at the local level, and police personnel, particularly in supervisory positions, need to receive regular training in blockade formation. Finally, the importance of search information updates and enhanced interregional communication must be recognized.

Barrett (1990, pp. 70-71) documented several police experiential observations regarding the connection between locations of crime sites and area of offender residence. He suggests that if the murder and body dump site are different, then the killer generally lives in the area where the victim was attacked. Conversely, if the victim was left at the murder scene then the killer is probably
A crime scene close to a major road is an indication that the murderer may not be from the area, while a crime scene a mile or more from a major road suggests that the killer is local. A hidden body may mean that the killer is more or less geographically stable and wishes to reuse the dump site area, while an unconcealed body suggests that the murderer is transient, unconcerned over the police discovery of the victim.

Barrett (1990, pp. 82-83) also proposes that the method of body disposal can indicate the underlying reason for the murder. For example, a concealed body may suggest that the killer is planning on continuing the crimes. A body left in a clothed condition, and in an open location, might indicate remorse on the part of the murderer; such a victim may be symbolic, viewed with “affection” by the offender. A body left unhidden and in a mutilated condition may mean that the killer is asserting his power over society by shocking and frightening the community. And Newton (1992, pp. 60-62) comments on a peculiar habit of serial killers to ritually dump their victims in clusters, or private “totem places” — locations having significance, beyond convenience, for their fantasies.

52 This observation is inconsistent with the earlier finding that disorganized killers, who tend to live close to their crime sites, usually leave the victim’s body at the murder scene. It may be that Barrett is only referring here to organized offenders.
There have been only a few documented cases where a geographical analysis was applied to a serial murder investigation. During 1977, in an effort to focus the Hillside Strangler investigation, the Los Angeles Police Department (LAPD) attempted to determine the most likely location of the scene of the homicides. It was correctly suspected that the actual murders had occurred in the residence of one of the offenders. The police knew where the victims had been apprehended and where their bodies had been dumped, and the distances between these two points (Gates & Shah, 1992, pp. 163-167). The LAPD computer analysts viewed the problem in terms of a Venn diagram, with the centre of each circle representing victim availability, the circumference representing offender movement capacity, and the radius representing offender mobility (C. Holt, personal communication, February 22, 1993).

Vectors drawn from the point where the victims were abducted to the location where their bodies were found were resolved down to a common radius, which defined a circle encompassing an area of just over 3 square miles. The LAPD saturated this “sphere of concern” with 200 police officers in an attempt to find the murderers. While they were not successful, it is possible that the heavy police presence inhibited the killers, and prompted serial murderer Kenneth Bianchi’s move from Los Angeles to Bellingham, Washington. The centre of this
zone, the LAPD later found out, was not far from co-killer Angelo Buono's automobile upholstery shop-cum-residence (Gates & Shah, 1992, p. 166).

Geographic techniques were also used in the Yorkshire Ripper investigation. With the murders still unsolved after 5 1/2 years, Her Majesty's Inspector of Constabulary Lawrence Byford implemented a case review process (Kind, 1987a). An Advisory Group, comprised of senior police officers and a Home Office forensic scientist, met in December 1980 to examine the investigation (Doney, 1990, p. 103; Kind, pp. 385-386). Detectives had become divided over the issue of the location of the killer's residence. The school of thought led by the chief investigating officer believed that the Ripper was from the Sunderland area, while other investigators thought that he was local to West Yorkshire where most of the crimes had occurred (Nicholson, 1979, chap. 7). After an intensive investigative review the Byford advisory team came to the latter conclusion.

To help test this deduction they applied two "navigational metrical tests" to the spatial and temporal data associated with the crimes (Kind, 1987a, pp. 388-390). The first test involved the calculation of the centre of gravity (spatial mean) for the 17 crimes (13 murders and 4 assaults) believed to be linked to the
Yorkshire Ripper.\textsuperscript{53} The second test consisted of plotting time of offence against length of day (approximated by month of year). The rationale behind this approach had its basis in the theory that the killer would not be willing to attack late at night if his return journey to home was too far.

The first navigational test resulted in the finding that the centre of gravity for the Ripper attacks lay near Bradford. The second test determined that the later attacks were those located in the West Yorkshire cities of Leeds and Bradford. Both tests therefore supported the team's original hypothesis that the killer was local to that area. The Advisory Group's interim report recommended that "a special team of high-grade detectives be dedicated to enquiries in the Bradford area" (Kind, 1987a, p. 390).

Three weeks later, in January 1981, Peter William Sutcliffe was arrested by two patrol officers in Sheffield's red-light district. Sutcliffe, a truck driver who later confessed to being the Yorkshire Ripper, resided in Heaton, a suburb of Bradford. While the resolution of the case occurred independent of the recommendations of the Advisory Group's interim report, the suggestion to focus

\textsuperscript{53} The actual toll at this time was 13 murders and 7 attempted murders; the Byford Advisory Team missed one of the Yorkshire Ripper's victims, and, instead, included one unrelated murder.
on the Bradford area was valid and might have, if made sooner, led to an earlier case closure resulting in fewer deaths (Kind, 1987a, p. 392).

Professor David Canter, a psychologist now at The University of Liverpool who has provided offender profiles for several British criminal investigations, notes that “one of the most successful components of the reports we have given to police forces has been an indication of where the assailant might live” (Canter, 1994, p. 283). The first major inquiry that he was involved with was Operation Hart, set up to apprehend the Railway Killer who raped and murdered several females in the Greater London area from 1982 to 1986 (Canter, pp. 21-53; Lane & Gregg, 1992, pp. 147-150).

Blood typing reduced the register of over 5,000 suspect names down to 1,999. The 1,505th name on this list was John Francis Duffy, subsequently sentenced to seven life terms for these crimes. When Canter prepared his report one of his predictions was that the offender probably lived in the region circumscribed by the first three offences – the Kilburn/Cricklewood area of northwest London. This was, in fact, where Duffy had lived at the time, and the profile helped the police to successfully focus on him amongst all the other suspects in their register (Copson, 1993, pp. 9-10).
Canter had noticed a chronological pattern in the locations of the crime sites and correctly interpreted this as resulting from a process of learning and planning on the part of the offender. He reasoned that the earliest offences would be closer to the Railway Killer's home, while the later ones would be further away. It turned out that Duffy, who worked as a carpenter for British Rail, often travelled to his later crime sites by train.

In another case, Professor Canter and Detective Constable Rupert Heritage of the Surrey Police correctly anticipated the home area of the Tower Block Rapist in Birmingham (Canter, 1994, pp. 117, 122-147). Responsible for a number of sexual assaults on elderly women from 1986 to 1988, Adrian Babb concentrated his hunting in blocks of high-rise apartments situated in the Edgbaston and Druids Heath districts, on the edge of the city centre. The attacks conveyed a strong sense of area familiarity, but at the same time, a confidence in anonymity. This suggested that the offender resided close by but not in the immediate neighbourhood. Furthermore, the rapist's comfort in prowling through the victims' high-rise apartment buildings, which Canter labelled "streets in the sky," indicated he lived in such a structure himself.

In discussions with local police officers, Canter and Heritage discovered that the target area was a patchwork of distinct territories, divided by
Birmingham’s busy arterial routes. This pattern was used as a basis for inferring the offender’s mental map; such an understanding, when combined with victim specificity information and neighbourhood race and population data, allowed them to correctly predict the location of Babb’s home base in nearby Highgate.

An interesting geographic pattern was observed by former police officer Chet Dettlinger during the Atlanta Child Murders (Dettlinger & Prugh, 1983, chap. 6; see also “Investigators believe many killers,” 1981). For each known victim Dettlinger mapped home address and place last seen, in addition to body dump site. He noted that these locations clustered along 12 major streets in Atlanta that could be linked together in a boot-shaped configuration. Questioning the value of such a map police denied the existence of any geographic pattern (p. 104). But in the midst of one of these clusters lay Penelope Road – the home of Wayne Williams.

Newton and Newton (1985) applied what they termed geoforensic analysis to a series of unsolved female homicides that occurred in Fort Worth, Texas, from 1983 to 1985. They found that localized serial murder or rape tends to form place-time patterns different from those seen in “normal” criminal violence. They analyzed the unsolved Fort Worth murders by employing both quantitative (areal
associations, crime site connections, centrographic analysis) and qualitative (landscape analysis) techniques.

Their work has probably been amongst the most advanced in the area of geographic analysis of crime scenes (see Egger, 1990, p. 197), but the conclusions they make in the Fort Worth case are presented with too much confidence. This type of analysis, indeed any profiling effort whether geographic or psychological, is only capable of making probabilistic suggestions — not definitive statements — concerning some component of the offender’s nature.

Newton and Swoope (1987) also utilized geoforensic techniques in a retrospective analysis of the Hillside Strangler case. Different geographic centres (spatial means) were calculated from the coordinates of the locations of various types of crime sites. They discriminated between points of fatal encounter, body or car dump sites, and victim’s residences, finding that the geographic centre of the body dump sites accurately predicted the location of the residence of murderer Angelo Buono. A search radius (circumscribing an area around the geographic centre in which the killers were thought to most likely be found) was also calculated, the range of which decreased with the addition of the spatial information provided by each new murder.
When they plotted these locations on a map of Los Angeles, Newton and Swoope detected what they term a "coal-sack effect" – the presence of an area surrounding the home of Buono in which no crimes were known to have occurred. This appeared as a conspicuous void in the pattern of points that represented the crime sites of the Hillside Strangler. They suggest that the discovery of such a phenomenon, presumably resulting from a desire on the part of the killer to avoid drawing attention too close to home, should alert police to the investigative significance of the area.

Rogers, Craig, and Anderson (1991) discuss the potential application of geographic information systems (GIS) to the investigation of serial murder. Since a GIS can store geographic attributes and integrate spatial and other data for analytic purposes, it could assist in the reduction of linkage blindness and help identify crime series (see Anderson, 1992; Clarke, 1990; Garson & Biggs, 1992; Goodchild, Kemp, & Poiker, 1990a, 1990b; Miller, 1993; Tomlin, 1990; Waters, 1995; Wendelken, 1995). "Geographically coded information from police records can be used to detect crime trends and patterns, confirm the presence of persons within geographic areas, and identify areas for patrol unit concentration" (Rogers et al., p. 17, quoting from a 1975 International Association of Chiefs of Police (IACP) report). They also suggest that it might be possible to identify serial murder solvability factors, using a GIS, through retrospective analysis of known
cases. This is an interesting idea that is related to the current research – applying geographic techniques to understand solved cases. Such knowledge can then be used to assist police investigators in their efforts to clear unsolved murders.

Along such lines, Canter and Gregory (1994) have developed a small scale expert system designed to predict the location of a criminal’s home base. Their predictive model is based on data from a study of 45 serial rapists responsible for 251 offences committed during the 1980s in Greater London and Southeast England. The mean number of rapes per offender in this sample was 5.6 (standard deviation = 3.6), with a minimum of 2 and a maximum of 14 (pp. 170-171). It was theorized that those offenders with greater access to resources would exhibit longer journeys to crime. Therefore, those rapists with a better knowledge of geographic areas, greater financial resources, and more time availability should have the capability of travelling further distances to commit their crimes.

Age, ethnicity, venue, and timing – information likely to be known to police during the course of an investigation – were selected as “resource facets.” Canter and Gregory (1994, p. 172) made the following hypotheses: (1) older rapists would have the capability to journey further than younger rapists; (2) white rapists would travel further than black rapists, because of the disadvantages experienced by ethnic minorities; (3) outside rapists might have to search longer and further to
find a suitable crime site than inside rapists; and (4) weekend rapists would have more time to be away from home, and thus could journey further than weekday rapists.

White rapists were found to travel further to commit their crimes than black rapists, the latter having an 80% chance of having their home base within 1/2 mile of one of their offences (Canter & Gregory, 1994, p. 172). Those rapists who chose outside venues typically journeyed 2.7 times as far as those who chose inside or mixed venues. Weekend rapists averaged minimum crime trip distances 2.5 times as great as weekday offenders, though this difference was not statistically significant. Older rapists (over 25 years of age) appeared to travel further than younger rapists, but this finding was also not statistically significant.

The percentages for each group found to have travelled under 1/2 mile from their home base to their first (known) offence were as follows: blacks, 74%; whites, 18%; inside/mixed, 70%; outside, 28%; weekday, 41%; weekend, 50%; mixed, 60%; under 25 years of age, 54%; over 25 years of age, 38%; and total, 47% (Canter & Gregory, 1994, p. 172).

The four dichotomized parameters were used to form groupings within which the minimum and maximum distances from home base to first offence were determined. Centring these two distances on the location of a rapist’s first crime
defines a ring, the area of which Canter and Gregory (1994) propose is likely to contain the offender's home base. They found that such crime trip annuli contained the rapist's home base 100% of the time (p. 173). The annulus mean area was 87.5 square miles (standard deviation = 77.6).

To further narrow the search, the expert system was refined by including the concept of the circle hypothesis prediction area (offence circle). This is the area enclosed by the circle formed from a diameter produced by the line connecting the two offence sites most distant from each other. Offence circles circumscribed all of the crime sites for 91% (41/45) of the rapists, and 77% of the offences for the remaining 9% (Canter & Gregory, 1994, pp. 171-172; Canter & Larkin, 1993, pp. 66-67). They were also found to contain the location of the offender’s home base 87% (39/45) of the time. The mean area of the offence circles was 177.1 square miles (standard deviation = 490.1).

It was postulated that the intersection of the offence circle and the relevant crime trip annulus would delineate a zone in which the offender’s home base was most likely to be located. Canter and Gregory (1994, p. 173) determined that 83% of the rapists in the study lived in this region, which averaged 11.4 square miles (standard deviation = 16.8) in area – a much more manageable size for the purposes of assisting a police inquiry. They propose that these ideas could lead to
the construction of an intelligent expert system, designed to develop in parallel with the input of new data (p. 174).

While the basic premise of Canter and Gregory's expert system may be feasible, there are several methodological problems with the manner in which they have tested it. First, while the details are not articulated, the groupings used to determine minimum and maximum crime trip distances appear to be based on a combination of the four resource facets. Such a crosstabulation produces a matrix of $24 (2 \times 2 \times 3 \times 2)$ categories, and with a sample size of 45 offenders, this equates to an average of fewer than 2 rapists per group. Furthermore, no information is given on possible variable interaction effects.

Second, the sample may not be representative of all rapists. In particular, because the study examined solved cases, there could well be a bias towards those offenders who lived closer to their offence sites – a characteristic that facilitates case resolution. This is not an uncommon problem, however, as offender residence information is necessary to study journeys to crime.

Third, since the crime trip annuli were found to circumscribe all the rapists' home bases, and the offence circles 87%, then their intersection must contain 87%
of the home bases – not the reported 83%. Boolean algebra can be used to calculate the intersection probability. Generally, if:

\[ P(A) = 1 \land P(B) = p \supset P(A \cap B) = p \]  

(9)

where:

- \( P(A) \) is the probability that the offender’s residence lies within area \( A \);
- \( P(B) \) is the probability that the offender’s residence lies within area \( B \); and
- \( p \) is the probability that the offender’s residence lies within the intersection of areas \( A \) and \( B \).

And fourth, it appears that the expert system’s learning data set and prediction data set were the same. This must be the situation as each resource facet group has a maximum crime trip distance case that, if it were excluded during its own comparison, would have to fall outside the crime trip annulus, making a finding of 100% inclusion impossible. But by comparing a case against a data set that includes crime trip information concerning that offender, the expert system becomes a logical tautology. We therefore have no idea of the performance
of the Canter and Gregory model beyond the discrimination provided by the
offence circle. While the fact that this area included 87% of the offender’s home
bases is promising (though this finding was not replicated in two North American
studies – see below), the average size of an offence circle, at 177 square miles, is
much too large to be of significant value in most police investigations.
CHAPTER IV

METHODOLOGY

The dissertation research involved the collection and analysis of two forms of data: (1) macrolevel data about serial killers; and (2) microlevel data about selected serial murders.

Macrolevel Data

The first database contains information, where known, on: (1) offender’s name; (2) moniker or media name; (3) sex; (4) associates; (5) number of confirmed victims; (6) number of suspected victims; (7) start date of murders; (8) end date of murders; and (9) cities, states or provinces, and countries of operation. The data consist of 225 cases including most known serial killers. The main source for this information was an FBI Investigative Support Unit *Lexus/Nexus* newspaper computerized topical search file on serial murderers in the United States. Consequently, the data primarily, though not exclusively, involve U.S. cases.

An attempt was made to clean and verify the information in the original FBI list, and certain cases that appeared to be closer to a spree or mass murder
classification were eliminated. To this end, the FBI definition of serial murder was used (see Ressler et al., 1988, p. 139). Other cases were added, and while there was no attempt to be comprehensive, an effort was made to update the data and include well-known foreign serial killers.

**Newspaper Data Sources**

While many serial murder researchers have used newspaper files as sources for their data, a few cautions are worth noting. Egger (1990) states that "it would appear that the mass media are currently the only source from which to quantify serial murders in this country [United States]" (p. 11). He searched the *New York Times Index* from January 1978 to June 1983 for cases of serial killers (1984, 1990, pp. 11-13). Simonetti (1984) perused the same index and associated microfilm files, from January 1970 to November 1983, for stories of serial murder cases. Jenkins (1988a, 1989) researched newspaper archives, including the *New York Times Index*, to compile a list of major cases of serial murder in the United States, from 1900 to 1940, and from 1960 to the present, finding just as much journalistic interest in such killers in the early part of this century as in the later.
Levin and Fox (1985, pp. 45-47) searched indices of six major American newspapers for the period from 1974 to 1979, for serial and mass murder cases involving a minimum of four victims. Hickey (1991, pp. 17-19) identified serial murder cases from 1795 to 1988 through a variety of sources including newspapers, journals, biographies, interviews, bibliographies, and computer abstract searches.

Any time the media are used as a source of information, it becomes important to ascertain the existence of possible biases in the reporting of the stories of interest. Kiger (1990) warns that “newspaper stories are problematic sources of data because they are obviously dependent upon editorial decisions and because they may sensationalize (not to mention glorify) this phenomenon in order to increase circulation” (p. 37). In his analysis of the Henry Lee Lucas serial murder case, Egger (1990, p. 137) found that newspaper accounts were often inaccurate in their description of details and thus had to be treated as suspect.

Kiger (1990, p. 37) further cautions that a string of murders must first be identified as part of the same series before the existence of a serial killer will even become suspected54 (see the above discussion on linkage blindness). Newspaper

54 It is always possible that purported but unidentified serial murderers, such as Jack the Ripper or the Green River Killer, did not actually exist. While that is unlikely in
reporting inaccuracies, and the definitional problems previously examined, can further complicate media source research. For example, upon perusing case details in microfilmed newspaper articles Simonetti (1984, p. 11) found that some so-called incidents of serial murder were actually mass murders.

Jenkins (1988a) discusses the problems of historical changes in media practices and coverage, and the possibility of a tendency towards greater coverage of events that occur in large urban areas. He notes that major metropolitan papers expanded their coverage of regional issues in the 1950s, and since 1960, the proportion of national newspaper chains has tripled (1992b, pp. 4-6). In subsequent research, however, he concludes that such concerns do not present major research difficulties or significant data biases (1989a, pp. 378-379).

These problems with media data suggest a potential bias in the current research. The crimes of repetitive killers who hunt over wide geographic regions may, because of linkage blindness, be unidentified as serial murders. Those attacks which lack a consistent modus operandi and are spread out over long

---

these particular cases, it is certainly feasible that the press or the police could incorrectly link a number of unconnected homicides (see Jenkins, 1989, p. 379). This is apparently what happened with a 1984 to 1985 series of murders of women in Fort Worth, Texas (Jenkins, 1993b, p. 473).
periods of time are even less likely to be connected. Such crimes fall into the "dark figure" of serial murder and are thus not open to the above mentioned methods of information gathering, possibly skewing data collection towards more geographically confined serial murderers.

**Microlevel Data**

The second database was derived from a sample of the macrolevel data. The macrolevel data set was regarded as a reasonable approximation of the serial killer “population.” While an accurate accounting of all serial murderers does not exist, and most likely never will, the best efforts to date suggest that the size of the modified FBI list is on the right order of magnitude (see Cavanagh, 1993; Hickey, 1991).

**Sampling Procedure**

In order of application, criteria for selection of cases for the microlevel data set included the following requirements:
1. The case must be solved (i.e., there is a known offender associated with the murders). Otherwise, any information related to the murderer, and his or her residence, cannot be ascertained.

2. There must have been a minimum of 5 murder victims. The random fluctuations caused by a small number of crimes affect the predictive power of any statistical model designed to locate offender residence. "As a serial killer increases the number of his kills, a pattern will emerge because, like all other humans, he is a creature of habit" (Cleary & Rettig, 1994, p. 7).

3. The murders must have commenced in 1960 or later. Killers from earlier time periods might have behaved in a geographic manner different from what is commonly seen today. Advances in transportation, rapid transit, and automobiles, and other technological, economic, and social factors, are likely to have influenced spatial behaviour. Furthermore, many cities have significantly changed and grown over the years and it would be difficult to obtain accurate period street maps.

4. There must have been no more than two offenders involved in the case. More than one offender can bring the influence of two residences, two
activity spaces, and two mental maps into play, confusing the analysis. While it was possible to address this difficulty for two killers, three different offenders creates potentially too complex a situation.

5. There must be information available about the case. For various reasons, certain cases have received little press coverage and, despite an extensive literature search, little could be found concerning them.

6. There must have been at least 5 different locations of the same type (i.e., encounter sites, attack sites, murder sites, body dump sites, or vehicle drop sites) associated with a single offender residence. This condition is related to criterion number 2, but while the stipulation of a minimum of 5 victims usually translates into 5 different locations, there are several cases in which the murderer attacked more than one person at a time (Edmund Kemper III and Richard Ramirez, for example). Furthermore, if a killer moved residence halfway through a crime series, and if that series involved fewer than 10 murders, then neither residence would have the necessary requirement of a minimum of 5 different crime locations associated with them.

7. The serial killer must not have been nomadic; in other words, the offender must have had a residence. For example, the peripatetic
movements of Henry Lee Lucas produced such a random pattern that little useful information can be derived from his target sites. In effect, he did not have a residence to relate to the locations of his crimes.

8. The serial murderer must not have predominantly been a trapper (an offender who selects victims who happen to come into a location, such as a residence or workplace, controlled by the offender). For example, Donald Harvey poisoned hospital patients while working as an orderly, while Harvey Glatman strangled young women he had attracted through want ads for models placed in the classifieds. These individuals hunt in such a manner that the finding of the offender’s residence or workplace usually turns into a redundant task once their crimes become known.

9. There must have been a reasonably uniform target or victim backcloth. Nonuniform target backcloths limit opportunities for victim selection, constraining the offender’s choices. This distorts, to varying degrees, the spatial pattern produced by the crime sites. Murderers who seek victims in red-light zones or gay bars, for example, most often fall into this category.

10. There must have been suitable and sufficient information available on the addresses or locations of the crimes, and the offender’s activity
space (in particular, residence), for a spatial analysis. This requirement is related to criterion number 5.

The use of these criteria structured the sampling procedure. Specifically, only serial killers responsible for 5 or more victims, after 1960, who were residentially stable, operated by themselves or with a single partner, and who hunted in certain ways, were included. This selection process helped to define the appropriate limits of the analysis and assisted in the development of a typology that helped prevent misapplication of the model.\textsuperscript{55}

The other criteria, while necessary, were more problematic. By focusing only on solved cases the research did not address the spatial behaviour of those killers who have so far escaped detection. Indeed, some serial killers may never have been recognized as such, with no official knowledge of their existence beyond an unconnected series of missing person reports. It is important to remember, however, that there would be no attempt to find the offender in such cases as there would be no police investigation.

\textsuperscript{55} To have value in the investigation of an unsolved serial murder case, such a classification must be determinable from information likely to be known to police prior to the killer's apprehension. The present typology was developed with this consideration in mind.
The requirements for adequate information also introduced a certain distortion. A lack of press interest or published information may have skewed the sample towards those incidents that were seen as newsworthy, perhaps because they were particularly heinous or involved a large number of victims. Jenkins (1993a) points out that little attention has been given in the criminological or popular literature to African-American serial murderers. Foreign cases, particularly those from non-English speaking countries, were also more likely to be excluded. Finally, in those cases where the killer did not confess or cooperate with the authorities, certain types of information may not be known (e.g., the locations of the murder sites, if different from the encounter and body dump sites).

This selection process reduced the 225 serial killers in the macrolevel data set to 21 offenders (9.3% of the total), representing 19 unique serial murder cases. Table 3 shows the breakdown of the number of killers excluded by each of the criterion.
The selection criteria can be grouped into the following three general categories: (1) information ("case solved," "non-trapper," "occurred after 1960," "case information available," and "addresses published"); (2) number of locations ("5 or more victims," and "5 locations/residence"); and (3) offender behaviour.
("fewer than 3 killers," "non-nomadic," and "uniform target backcloth"). Categorization in this manner allows some estimate\textsuperscript{56} of the proportion of prospective serial murder cases theoretically amenable to offender residence prediction through analysis of crime site locations.

Approximately 37\% of the total number of cases are inappropriate because of the behaviour of the offender. This includes those instances where the murderer's choice of victim was such that the target backcloth was nonuniform, where more than two murderers were involved (inappropriateness in such a case is unknown), and where the murderer did not reside in a fixed location.

Of the remaining cases, only 53\% (34\% of the total) involved those with five or more distinct locations. While the proposed model of offender residence location could be applied to cases with fewer crime sites, accuracy and reliability will be reduced as the predictive power is a function of number of crime sites (see below). Of course, no matter how many murders he or she eventually commits, every serial killer will be responsible for fewer than five offences in the early stages of their career.

\textsuperscript{56} The stepped manner in which the sampling was conducted limits the accuracy of such an assessment, and the estimate will be biased to the extent that the criteria lack mutual independence.
Finally, about 28% of the serial murderers were eliminated from the macrolevel data set because information problems precluded proper study. While such problems were of concern in a retrospective analysis, they are not issues in a prospective examination for an ongoing investigation. For example, if a trapper serial killer has murdered and buried a number of people, the police will either have uncovered the bodies or will be unaware of the existence of a serial murder case. Crime site information exists for the former scenario, while in the latter, no police investigation would have been initiated. The serial murder microlevel data analysis examines such information-related issues as whether a crime location was known during the police investigation (i.e., prior to the apprehension of the killer), and if a victim was linked to the murder series.

**Data Coding**

A sample of 10 cases randomly drawn from those that met the selection criteria was used to examine the microlevel geography of serial murder. An additional 3 cases that violated various selection criteria were also studied. This was done in order to assess the impact of the violations on ability to predict offender residence location.
These 13 cases served as the basis for the construction and optimization of a model that, through analyses of crime site locations, attempts to predict the whereabouts of the offender's anchor point (residence or workplace). Where available, information in this database includes: (1) date of murder; (2) day of murder; (3) time of murder; (4) sequential case number; (5) weapon; (6) vehicle use; (7) degree of offender organization; (8) serial killer classification; (9) hunting typology; (10) victim traits (specific or nonspecific); (11) victim selection (random/nonpatterned or nonrandom/patterned); (12) victim activity; (13) offender residence (address, and \( x \) and \( y \) coordinates); (14) offender workplace (address, and \( x \) and \( y \) coordinates); and, for all known crime locations connected to each murder, (15) area description; (16) neighbourhood type; and (17) the \( x \) and \( y \) coordinates. Appendix B contains the serial killer, victim, and crime location data coding forms. Data coding procedures and guidelines can be found in Appendix C.

Through the use of a relational database management system the crime locations were hierarchically connected through the common murder, and the murders linked through the common killer. Further data items were calculated from these relationships (such as the distance from residence to crime site). A
total of 13 serial murder cases, comprising 15 serial killers, 178 victims, and 347 crime locations, constitute this data set.

**Macrolevel Analysis**

The data set on serial killers served two analytic purposes. First, it was the means by which frequencies, averages, and rates were computed for the macrolevel offender-based variables. Regional variation in serial murder was also examined through state comparisons of counts and rates (adjusted for both population and overall murder).

Second, the serial killer data set was the derivation source for the microlevel serial murder data set. One of the critical elements of the selection criteria involved choosing those cases where the serial killer’s activity space and hunting style produced target patterns that are amenable to activity space/crime location analysis (see the problems involved in the cases of Henry Lee Lucas and Donald Harvey, discussed above). This ultimately led to the development of a hunting typology for serial murderers, a necessary step in the articulation of the limits of the analysis. The serial killer data set made this process feasible.
Serial Murderer Hunting Typology

Throughout accounts of serial murders run themes of adventurous risk in the stalking of human prey by stealth or deception, the excitement of the kill ... The egoism of the hunter permits the degradation of potential victims to the level of wild game. The planning, excitement, and thrill of the hunt overrides all other considerations except eluding capture. (Green, 1993, pp. 143, 147)

Predatory criminals employ various hunting styles in their efforts to seek out and attack victims. These, in turn, affect the spatial distribution of the offender’s crime sites suggesting that any effort to predict serial killer residence from murder locations must consider hunting style. It was therefore important to ascertain those methods of hunting that produce target patterns inappropriate for this type of spatial analysis. Previous classifications of serial murder geography have only been descriptive of the final spatial pattern and not on the processes that produced those outcomes (see above). It was therefore necessary to develop a hunting typology relevant to serial killers. The construction of this scheme was informed by both geography of crime theory and an exploratory analysis of the data on serial killers.

While a serial murder can potentially involve several different types of crime locations, experience has shown that victim encounter and body dump sites
are most important in terms of an investigation-oriented geographic analysis. These are the location types most likely to be discovered by the police; attack and murder scenes, if different from encounter and dump sites, are usually known only to the murderer. The hunting typology is therefore concerned with offender behaviour vis-à-vis these particular crime locations.

Search and Attack Methods

The serial killer hunting process can be broken down into two components: (1) the search for a suitable victim; and (2) the method of attack. The former influences selection of victim encounter sites, and the latter, body dump sites. The hunting typology suggested by the data in the present study results from the categories produced by a combination of these elements.

The following four victim search methods were isolated:

1. Hunter – A hunter is defined as an offender who sets out specifically to search for a victim, basing the search from his or her residence.

2. Poacher – A poacher is defined as an offender who sets out specifically to search for a victim, basing the search from an activity site other than
his or her residence, or who commutes or travels to another city during the victim search process.

3. Troller – A troller is defined as an offender who, while involved in other, non-predatory, activities, opportunistically encounters a victim.

4. Trapper – A trapper is defined as an offender who assumes a position or occupation, or creates a situation that allows him or her to encounter victims within a location under their control.

The following three victim attack methods were isolated:

1. Raptor – A raptor is defined as an offender who attacks a victim upon encounter.

2. Stalker – A stalker is defined as an offender who first follows a victim upon encounter, and then attacks.
3. Ambusher – An ambusher is defined as an offender who attacks a victim once he or she has been enticed to a location, such as a residence or workplace, controlled by the offender.57

Hunters are those killers who specifically set out from their residence to look for victims, searching through the areas in their awareness space that they believe contain suitable targets.58 The crimes of a hunter are generally confined to the offender’s city of residence. Conversely, poachers travel outside of their home city, or operate from an activity site other than their residence, in the search for targets. The differentiation between a hunter and a poacher, however, is often a difficult and subjective task.

In their study of serial rape in England, Canter and Larkin (1993, pp. 65-66) used the offence circle concept as a means of dividing offenders into “marauders”

57 This typology is remarkably similar to Schaller’s (1972, pp. 240-251) description of certain hunting methods used by lions in the Serengeti where he observed ambushing, stalking, driving (direct attack), and unexpected (opportunistic) kills.

58 Westley Allan Dodd, a serial killer executed for the murder of three children in the state of Washington, wrote in his diary, “Now ready for my second day of the hunt.... Will start at about 10 a.m. and take a lunch so I don’t have to return home.” He was worried, however, that if he murdered a child in the park through which he was searching, he’d lose his “hunting ground for up to two to three months” (Westfall, 1992, p. 59).
or “commuters.” Marauders are individuals whose residences act as the focus of their crimes. Commuters, on the other hand, travel from home into another area to commit their offences. It was hypothesized marauders would have homes situated within their offence circle, while commuters would have homes located outside. Only 13% of the 45 British serial rapists had their home base situated outside of their offence circle (pp. 67-68). Finding little support for the commuter hypothesis, Canter and Larkin (pp. 63-64, 68) concluded that rapists, like most people, are typically “domocentric.”

The FBI, however, observed that 51% of 76 serial rapists (from the 108 such offenders in their U.S. study, responsible for a total of 565 rapes) lived outside of their offence circle, and that 76% resided outside of the convex hull polygon (CHP) created by their crime site pattern (Warren et al., 1995, pp. 48-50, 59, 81-82; Reboussin, Warren, & Hazelwood, 1993, pp. 150, 152). Alston (1994, pp. 65-69) had findings similar to those of the FBI in a study of 30 British Columbia stranger sexual assault series, involving 183 incidents. He determined that in 43.4% of the cases the offence circle did not contain an offender activity node. The inconsistency in these findings may be attributable to differences

59 Activity nodes may contain many locations in addition to residence. The definition used by Alston (1994, pp. 44-46) included offender’s past and present homes, current and previous work sites, and residences of partners, friends, and family members.
between European and North American urban structure, neighbourhood density, and travel behaviour (Warren et al., 1995, pp. 224, 253).

One of the problems with the circle hypothesis is its determination of hunting behaviour solely from crime site point pattern (see Alston, 1994, for a discussion of other associated problems). In cases involving large numbers of offences the rapist may have commuted to several different areas in various directions, creating an offence circle which contains their residence. And in cases involving small numbers of crimes a marauder may have found all of his or her victims through travelling by chance in the same direction, resulting in an offence circle that excludes their home base. Offence circles could therefore lead to both commuter and marauder designations, depending upon what point in a serial rapist's career they were generated.60

This happened in both the Yorkshire Ripper and the Boston Strangler cases (Burn, 1984; Davies & Dale, 1995a, p. 7; Frank, 1966). In other instances a nonuniform target backcloth may force a commuter pattern regardless of the

60 The probability that the \( n \) crimes of a marauder will appear to be those of a commuter is approximately: \( \frac{2^n - 1}{2^{2n} - 2} \). The odds that such a pattern could happen by chance is not insignificant for low values of \( n \). For example, in a series of 4 crimes the probability is equal to 0.234.
offender’s hunting style. Davies and Dale warn “that the commuter and marauder models may just be extremes of a continuum of patterns determined by topography and target availability” (1995b, p. 16). Because of these problems, a more subjective interpretation of offender hunting style was used in this dissertation to classify serial killers as either hunters or poachers.61

Trollers are those killers who do not specifically look for victims, but rather encounter them during the course of other, usually routine, activities. Their crimes are often spontaneous, but many serial killers have fantasized and planned their crimes in advance so that they are ready and prepared when an opportunity presents itself. Trappers either assume positions or occupations where potential victims come to them, or entice them by means of subterfuge into their homes or other locations under their control. This may be done through entertaining suitors, placing want-ads, or taking in boarders. Black widows, “angels of death,” and custodial killers are all forms of trappers and most female serial murderers fall into

61 As part of a suggested taxonomy of rape series, Alston (1994, pp. 119-120) proposes that marauders be defined as those offenders who consistently travel under 5 kilometres from a primary activity site (e.g., home or work) to the initial victim contact scene. Commuters would be those offenders who travel more than 5 kilometres. Alston observes that the latter tend to stay close to the major thoroughfares used for their crime journeys.

206
Raptors, upon encountering a victim, attack almost immediately. Stalkers follow and watch their targets, moving into the victim’s activity space, waiting for an opportune moment to strike. The attack, murder, and body dump sites of stalkers are thus strongly influenced by their victims’ activity spaces. Ambushers attack those they have brought or drawn into their “web” — someplace where the killer has a great deal of control, most often their home or workplace. The victims’ bodies are usually hidden somewhere on the offender’s property. While victim encounter sites in such cases may provide sufficient spatial information for analysis, many ambushers select marginalized victims whose disappearances are rarely linked, even when missing person reports are made to the police.

62 While this theoretically does not have to always be the case, empirically it appears to be the rule. Such a finding may be a result of the fact that ambushers are often also trappers, and the latter rarely exhibit any significant degree of mobility.
Hunting Style

Target patterns are determined by offender activity space, hunting method, and victim backcloth. One of the main purposes of the hunting style typology was the identification of those situations where an analysis of the relationship between offender activity space and crime location geography is appropriate. This allows for the elimination of those cases where such an analysis is impossible or redundant. Poachers, for example, who live in one city and commit their crimes in another, may not reside within their hunting area. Stalkers, whose crime locations are driven more by the activity spaces of their victims than by their own, will not usually produce target patterns amenable to this type of spatial investigation. Figures 3 and 4 show, respectively, hypothetical target patterns for raptors and stalkers.

Table 4 presents the matrix produced by a crosstabulation of the search and attack methods, and the suitability of the resultant cells for a geographic analysis based on encounter and body dump sites. The matrix uses a sliding scale of designations (yes, possible, doubtful, and no) to refer to suitability likelihood. A designation of redundant refers to a situation where such an analysis is possible, but trivial. For example, the offender's address could be accurately determined from an analysis of the body dump site locations of a trapper serial killer (e.g., one
Figure 3. Raptor Target Pattern.
Figure 4. Stalker Target Pattern.
who entices victims into his or her home, murders them, and then buries their bodies in the backyard or basement), but such a circumstance negates any need for a spatial analysis. The cases of Belle Gunness, who poisoned her suitors, and Dorothea Puente, who murdered her elderly tenants, are examples of this type of situation.

<table>
<thead>
<tr>
<th>Encounter Sites</th>
<th>Search Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attack Method</td>
<td>Hunter</td>
</tr>
<tr>
<td>Raptor</td>
<td>yes</td>
</tr>
<tr>
<td>Stalker</td>
<td>yes (if known)</td>
</tr>
<tr>
<td>Ambusher</td>
<td>yes</td>
</tr>
</tbody>
</table>

| Attack Method   | Poacher       |
| Raptor          | doubtful      |
| Stalker         | yes (if known)|
| Ambusher        | yes           |

<table>
<thead>
<tr>
<th>Body Dump Sites</th>
<th>Search Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attack Method</td>
<td>Hunter</td>
</tr>
<tr>
<td>Raptor</td>
<td>yes</td>
</tr>
<tr>
<td>Stalker</td>
<td>possibly</td>
</tr>
<tr>
<td>Ambusher</td>
<td>redundant</td>
</tr>
</tbody>
</table>

| Attack Method   | Poacher       |
| Raptor          | doubtful      |
| Stalker         | no            |
| Ambusher        | redundant     |

| Attack Method   | Troller       |
| Raptor          | yes           |
| Stalker         | possibly      |
| Ambusher        | redundant     |

| Attack Method   | Trapper       |
| Raptor          | redundant     |
| Stalker         | redundant     |
| Ambusher        | redundant     |

Table 4. Serial Killer Hunting Typology and Geographic Analysis Feasibility.
As there appears to be a correlation between search and attack methods, actual serial murders tend to fit into some cells more often than others. For example, hunter/raptors and trapper/ambushers are much more common than hunter/stalkers or trapper/raptors. Also, the suitability ratings in Table 4 are only suggestive as individual cases may vary significantly from one another in terms of their spatial details.

While hunting style typology is helpful in determining when the different types of crime locations become the best predictors of the serial murderer’s anchor point, offender activity space and victim backcloth also influence target patterns. If the problem is to determine the location of the offender’s anchor point (residence or workplace), then the exercise becomes moot if no such place exists; in other words, if a serial killer is nomadic then the analysis is inappropriate. But for those offenders who have stable anchor points, the search and attack categories provide a typology for determining which serial murderers are most likely to have target patterns amenable to this type of spatial examination.

In this study, activity spaces were dichotomized on the basis of the constancy of the serial killer’s anchor point into: (1) stable (the offender had a permanent anchor point during the murder period); and (2) nomadic (the offender was transient and lacked a fixed anchor point). Albert DeSalvo, for example,
resided in the same dwelling throughout his killing period, while Ottis Toole lived on the road, travelling from city to city, and state to state.

Many serial murderers, however, fall somewhere between these two positions. David Berkowitz resided in two different locations in New York City during his crimes, while Ted Bundy, though not nomadic, moved several times during his murder spree (Terry, 1987, pp. 169-174; U.S. Department of Justice, 1992, p. 8). For this reason the sampling procedure contains criteria that disqualifies nomadic offenders, and requires that there have been at least 5 different locations of the same type associated with a single offender residence.

The uniformity of the target backcloth is a matter of degree, affected by geography, urban structure, population distribution, zoning, land use, target specificity, and victim selection. Those cases involving nonuniform target backcloths were excluded from the analysis as the encounter sites (and often, depending on the hunting style, the other crime sites) were determined by the activities of the victims, thereby constraining the offender’s rational choice process. This was the case, for example, in those murder series involving prostitute victims where the killer had to travel to a red-light district in order to hunt. This selection criterion also served as a surrogate measure for poachers as it
proved difficult to discern such offenders short of a detailed analysis of their crime sites.

Microlevel Analysis

The central theme of this research was the development and refinement of a model for predicting the whereabouts of the offender’s residence or anchor point from the locations of his or her crime sites. Some previous work in this area has been attempted (see above), but with limited results. These endeavours have generally used the spatial mean as the primary method of ascertaining the location of the offender’s residence. In some cases crime trip distances were also employed. For the reasons previously discussed, such approaches have had significant limitations that the current research has attempted to address.

Some of the related questions that this study has sought to answer include: (1) which crime location types, individually or jointly, are the best predictors of offender residence; (2) what do the characteristics of the crime site and surrounding area tell us about the offender; and (3) is it possible that the earlier crimes, committed before the killer gained experience and expanded his or her spatial repertoire, are better indicators of the location of the offender’s home?
The serial murder data set provided the information necessary for a microspatial analysis concerned with these and other issues. Area and neighbourhood characteristics, victim types and activities, date and time periods, and offender mobility were all examined. The information was also available to compute crime trip distances, size of hunting area, degree of pattern aggregation, and weekday of offence.

**Offender Residence Prediction**

Taylor (1977, p. 134) states that geographic patterns should be viewed through the processes that produce them. Consistent with this view, the Brantingham and Brantingham model of crime site selection was utilized in the present research as a heuristic for the construction of a model designed to locate offender residence. As Brantingham and Brantingham seek to describe where crimes are most likely to occur on the basis of the offender's activity space, the current effort is, in effect, an attempt to invert their model, using crime locations as the means for predicting the most probable areas in which the murderer's residence or workplace might be found. Such a system, however, would be algorithmic in nature (Benfer, Brent, & Furbee, 1991, p. 8). So while the two
models have different purposes and knowledge bases, their underlying concepts and ideas are similar.

Brantingham and Brantingham (1981, p. 31) suggest that, in the simplest case, offender residence lies at the centre of a crime pattern, and therefore might be approximated by the spatial mean. The intricacy of most activity spaces, however, suggests that more complex patterns may be appropriate. Rengert (1990, 1991) proposes four hypothetical spatial patterns that could be used to describe the geography of crime sites: (1) a uniform pattern with no distance-decay influence; (2) a bull’s-eye pattern with spatial clustering, exhibiting distance-decay, centred around the offender’s primary anchor point; (3) a bimodal pattern with crime clusters centred around two anchor points; and (4) a teardrop pattern with a directional bias oriented towards a secondary anchor point.\(^{63}\)

\(^{63}\) Many researchers have noted the importance of direction as well as distance in the analysis of spatial patterns of criminal behaviour. Rengert and Wasilchick (1985, pp. 68-74) found a directional bias in burglary towards offender workplace and recreation sites. In their Sheffield study, Baldwin and Bottoms observed that crime disproportionately occurred in the city centre, an indication of offender preference for such a bearing (1976, pp. 93-98). Costanzo, Halperin, and Gale (1986, pp. 90-93), who conducted a nonparametric assessment of the level of spatial autocorrelation present in the orientation of criminal travel, suggest that directional information could assist police investigations of certain types of crimes.
Situations can also be distorted by a variety of other real world factors - movement often follows a Manhattan metric, traffic flows can distort mobility patterns, variations exist in zoning and land use, and crime locations may cluster dependent upon the nature of the target backcloth. The spatial mean is therefore limited in its ability to pinpoint criminal residence. Can centrographic principles and journey to crime research be combined, in a manner informed by environmental criminological theory, to produce a viable method for predicting the location of offender residence from crime site coordinates?

Set theory provides a useful approach for addressing this problem (Taylor, 1977, pp. 9-10). Figure 5 shows a Venn diagram for three hypothetical crimes committed by a single offender and part of the same series. The medial circles surrounding each crime site location are defined by a radius equal to journey to crime distance \( d \), within the range of which percentage \( p (> 0.5) \) of the offender's crimes occur. The probability of the offender's residence lying within the area circumscribed by a single circle is therefore also \( p \). Because the crimes are connected, one of the lune overlap areas is more likely to contain the offender's

---

64 This procedure can be viewed as akin to constructing, through the use of geographic information, the intersection of investigative frames (Kind, 1987b, pp. 141-142).
Figure 5. Journey to Crime Venn Diagram.
residence. And in the middle region where all three of the circles intersect (shown in dark grey), there is an even greater probability.

The points most likely to mark the residence of the offender, in decreasing order of probability, lie within: (1) the middle intersection; (2) the lunes; (3) the circles; and (4) and the background area. The areal probabilities for the four different spaces delineated by the Venn diagram in Figure 5 are given in Equations 10 to 13:

\[
P(C_i) = p(1 - p)^2 \quad (10)
\]

\[
P(C_i \cap C_j) = p^2(1 - p) \quad (11)
\]

\[
P(C_i \cap C_j \cap C_k) = p^3 \quad (12)
\]

\[
P((C_i \cap C_j \cap C_k)' ) = (1 - p)^3 \quad (13)
\]

where:

\[P(A)\] is the probability that the offender’s residence lies within area \(A\);

\[C_x\] is the area around crime site \(x\) circumscribed by radius \(d\); and

\[p\] is the probability that the offender’s crime journeys will be \(\leq d\).
Relative probabilities for the points within the various areas are obtained by dividing the areal probabilities by area size (or number of “points”).

This process can be viewed as a simple dichotomous function dependent only upon whether or not a point lies inside one of the circles. Points in the overlaps of two, or all three of the circles, are given double or triple the value respectively. Such circles, however, are an oversimplified representation of journey to crime patterns. Both research and theory suggest that crime trip behaviour is better modeled by some form of Pareto function which incorporates the concept of a buffer zone.

A more sophisticated method of predicting offender residence location is obtained by replacing the circles in Figure 5 with a distance-decay function $f(d)$, a sort of fuzzy logic approach that better describes journey to crime behaviour (Kosko & Isaka, 1993; Yager & Zadeh, 1994). The value assigned to point $(x, y)$, located at distance $d$, from crime site $i$, is then equal to $f(d_i)$. The final value for point $(x, y)$ is determined by adding together the $n$ values derived at that point from the $n$ different crime sites.
Criminal Geographic Targeting

The effort to develop such a model has led to the creation of a computerized spatial profiling model called criminal geographic targeting (CGT). Criminal geographic targeting, by analyzing the spatial information associated with a series of linked crimes, attempts to determine the most probable areas in which the offender's residence might be located. It employs the information and insights provided by journey to crime research and addresses some of the problems associated with centrography. This model can also incorporate the effects of anisotropic travel and nonuniform target backcloths.

The use of CGT in actual police investigations, and tests of the model on solved cases of serial murder, rape, and arson, have produced promising results, usually locating the offender's residence in a small percentage of the total hunting area. The offender's hunting area is a rectangular zone containing all the crime locations, usually oriented along north-south and east-west lines (the exact specification is defined below.) These crime locations may be victim encounter

\[ \text{Due to the large number of calculations involved (up to 1,000,000), the model has been computerized by writing the process in QuickBasic language. Creating a software program to automate the mathematical procedures means that the required computations can be done in just a few minutes.} \]

221
points, murder scenes, body dump sites, or some combination thereof. The term hunting area is therefore used broadly in the sense of the geographic region within which the offender chose – after, presumably, some form of search or hunting process – a series of locations in which to engage in one of the above offence-related actions. There may be other crime locations not known to the authorities and therefore would not be included in the analysis. And this approach does not contain those locations in which the offender searched for victims or dump sites, but was unsuccessful or chose not to act.

The CGT model is based on the following four-step process:

1. Map boundaries delineating the offender’s hunting area are first calculated from the crime locations. Assuming a Manhattan grid oriented along north-south and east-west axes, the borders are determined by adding to the northernmost point 1/2 of the average y inter-point distance, subtracting from the southernmost point 1/2 of the average y inter-point distance, adding to the westernmost point 1/2 of the average x inter-point distance, and subtracting from the easternmost point 1/2 of the average x inter-point distance (for a discussion of alternative techniques for dealing with edge effects, see Boots & Getis, 1988, pp. 39-45):
\[ y_{high} = y_{max} + (y_{max} - y_{min})/2(T - 1) \]  
\[ y_{low} = y_{min} - (y_{max} - y_{min})/2(T - 1) \]  
\[ x_{high} = x_{max} + (x_{max} - x_{min})/2(T - 1) \]  
\[ x_{low} = x_{min} - (x_{max} - x_{min})/2(T - 1) \]

where:

- \( y_{high} \) is the \( y \) value of the northernmost boundary;
- \( y_{low} \) is the \( y \) value of the southernmost boundary;
- \( y_{max} \) is the maximum \( y \) value for any crime site;
- \( y_{min} \) is the minimum \( y \) value for any crime site;
- \( x_{high} \) is the \( x \) value of the easternmost boundary;
- \( x_{low} \) is the \( x \) value of the westernmost boundary;
- \( x_{max} \) is the maximum \( x \) value for any crime site;
- \( x_{min} \) is the minimum \( x \) value for any crime site; and
- \( T \) is the total number of crime sites.

2. For every point on the map, the Manhattan distances to each crime location are then determined. While there are an infinite number of mathematical points in any area, the model uses a limited number of
“points” (on the order of 10,000) based on the measurement resolution of the \(x\) and \(y\) scales.

3. Next, these Manhattan distances are used as independent variable values in a function which produces a number that: (a) if the point lies outside the buffer zone, becomes smaller the longer the distance, following some form of distance-decay; or (b) if the point lies inside the buffer zone, becomes larger the longer the distance. Numbers are computed from this function for each of the crime locations. For example, if there are 12 crime locations, each point on the map will have 12 numbers associated with it.

4. Finally, these various numbers are added together to produce a single score for each map point. The higher the resultant score, the greater the probability that the point contains the offender’s home or workplace. The resultant score function is presented in Equation 18:

\[\text{Equation 18}\]

\[\text{66 To be mathematically correct, the score function should actually use the product, rather than the sum, of these various numbers. The performance of a version of the CGT model that used the sum of the number’s logarithms appeared to be marginally superior. This version was not employed in the present research, however, as the size of the resultant scores created computer program difficulties and significantly slowed down the analysis.}\]

224
$P_{ij} = k \sum_{c=1}^{T} \left[ \phi / (|x_i - x_c| + |y_j - y_c|)^f + (1 - \phi)(B^{g-f})/(2B - |x_i - x_c| - |y_j - y_c|)^g \right] \quad (18)$

where:

$|x_i - x_c| + |y_j - y_c| > B \supset \phi = 1 \quad (19)$

$|x_i - x_c| + |y_j - y_c| \leq B \supset \phi = 0 \quad (20)$

and:

$P_{ij}$ is the resultant probability for point $ij$;

$\phi$ is a weighting factor;

$k$ is an empirically determined constant;

$B$ is the radius of the buffer zone;

$T$ is the total number of crime sites;

$f$ is an empirically determined exponent;

$g$ is an empirically determined exponent;

$x_i, y_j$ are the coordinates of point $ij$; and

$x_c, y_c$ are the coordinates of the $c$th crime site location.
GEOGRAPHIC PROFILING:
TARGET PATTERNS OF SERIAL MURDERERS

by

Darcy Kim Rossmo
M.A., Simon Fraser University, 1987

[ v. 2 ]

DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

in the School
of
Criminology

© Darcy Kim Rossmo 1995
SIMON FRASER UNIVERSITY
October 1995

All rights reserved. This work may not be
reproduced in whole or in part, by photocopy
or other means, without permission of the author.
A three-dimensional surface is produced when the probability for every point on the map is calculated. This surface can be represented by an isopleth or "fishnet" map with different scores on the z-axis representing probability density (Garson & Biggs, 1992, pp. 48-52). Such maps, a form of virtual reality (in the term's original sense), may be generated through computer-aided mathematical visualization techniques (see, for example, Figure 6,67 produced from an analysis of 18 crime site locations connected to John Duffy, the Railway Killer).

Alternatively, the probability surface can be viewed from a top-down perspective and depicted through a two-dimensional choropleth map (see Figure 7, which was derived from Figure 6) (Harries, 1990, pp. 31-37). If this is then overlaid on a city map of the targeted region, specific streets or blocks can be prioritized according to the associated values shown on the CGT choropleth probability map. The resulting map is called a geoprofile. Figure 8 shows offender residence area confidence intervals for a geoprofile involving a hypothetical crime series in the District of Columbia.

67 Figures 6 and 7 are reproduced in colour to more clearly show altitude and areal differences. Subsequent isopleth and choropleth map figures are reproduced in grey scale only.
Figure 8. Geoprofile Map.
Key to this process is the score function in Equation 18 which assigns probability values based on the distances between map points and crime locations. The Brantingham and Brantingham model suggests that the criminal search process can be modeled by a distance-decay curve, incorporating a buffer zone centred around the residence of the offender (see Canter, 1994, pp. 116-117). Assessing the validity and reliability of this process, and examining the influence of such other variables as offence timing, location characteristics, land use, size of hunting area, offender mobility, organized versus disorganized behaviour, and so forth, are important goals of the dissertation research.

A geoprofile less dictates where an offender lives than it describes a search process. A search that starts in the highest (i.e., most probable) area and works down will be more likely to find the offender sooner than a random process would. Search efficiency is therefore an indicator of the performance of the CGT model, and it can be measured by determining the proportion of the total hunting area covered before the offender’s residence was encountered. This ratio is referred to as the “hit percentage,” and the actual size of the region it represents is called the search area. These terms are discussed further in the following chapter.

---

68 It may be possible, for example, to predict whether an offender’s hunting base is a residence or workplace from the zoning classification of the geoprofile’s prioritized area.
CHAPTER V
RESULTS

Macrolevel Analysis

Serial Murderers

A breakdown of the characteristics for the 225 serial murderers in the macrolevel data set is given in Table 5. The complete list of serial killers is presented in Appendix A, Table A-1.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offender Identity</td>
<td></td>
</tr>
<tr>
<td>Known</td>
<td>93.8% (211)</td>
</tr>
<tr>
<td>Unknown</td>
<td>6.2% (14)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>90.7% (204)</td>
</tr>
<tr>
<td>Female</td>
<td>9.3% (21)</td>
</tr>
<tr>
<td>Co-Killer</td>
<td></td>
</tr>
<tr>
<td>Operated Alone</td>
<td>75.6% (170)</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Results</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Operated With Partner</td>
<td>24.4% (55)</td>
</tr>
<tr>
<td>Mean Duration of Murder Activity</td>
<td>4.4 Years</td>
</tr>
<tr>
<td>Mean Number of Confirmed Victims</td>
<td>9.7</td>
</tr>
<tr>
<td>Mean Number of Suspected Victims</td>
<td>13.3</td>
</tr>
<tr>
<td>Mean Number of Different Cities</td>
<td>2.8</td>
</tr>
<tr>
<td>Mean Number of Different States</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Table 5. Serial Murderer Characteristics.

There were 14 cases that had not been solved and where the identity of the offender was therefore unknown. As the macrolevel data set contained 225 serial killers from 193 unique cases, the proportion of unsolved cases was 7.3%. The percentage of female offenders in this sample is comparable to that found in previous research (cf. Hickey, 1991, p. 107; Newton; 1992, p. 49), as is the estimate for mean duration of murder activity (cf. Hickey, 1991, pp. 74-75; Jenkins, 1988b, p. 9). One-quarter of the serial murderers operated with a partner. The proportion of cases where the offender did not operate alone was 11.9%. This estimate is at the low end of the range found in previous studies (cf. Hickey, 1991,
Team killers averaged 1.7 partners.  

Figure 9 presents the distributions for number of confirmed and number of suspected victims by case. The mean for the suspected number of victims given in Table 5 was calculated after eliminating those cases that claimed 100 or more victims, as these figures were not considered reliable (if those cases were included, the mean increases to 18.7). The estimate for the mean number of different cities should be regarded with caution as the data appear to contain listings for both metropolitan areas (e.g., New York) and individual cities (e.g., Brooklyn, Queens).

State Comparisons

While many researchers have noted regional variations in multiple murder, there does not appear to be a consensus as to where the high rate areas actually are. The Pacific Northwest is often held out to be the location with the most incidents of serial murder (Egger, 1990, p. 213; Mathers, 1989). Cavanagh (1993)

---

69 Interestingly, hunting efficiency of solitary lions ranges from 8% to 19% but increases to 30% in cooperative hunts (Barnard, 1984a, p. 114; Schaller, 1972, pp. 254, 389, 445).
Figure 9. Distribution of Confirmed and Suspected Victim Numbers by Case.
found that 39.6% of serial murder victims were from the Pacific subregion, a proportion more than twice as great as the next highest subregion.

Levin and Fox (1985, pp. 60-64) observe that multiple murderers usually strike in urban areas, and those cities are most likely to be in New York, Texas, or on the West Coast (particularly Southern California). They are least likely to be in the Deep South (excepting the state of Texas). But 64% of the female serial killers in Keeney and Heide’s (1994c) study were from the South, with Florida the state most often represented (29%). Hickey (1991, pp. 77-79) found a lack of regionality in serial murder, though California reported more than twice the number of serial murder cases than any other state. In Cavanagh’s (1993) analysis, California had over four times the number of victims than New York, the next highest state. Hickey observes that population density, particularly in metropolitan areas, appears to be a more important correlate than region.

Jenkins (1990, pp. 143-144) suggests that the geographical concentration of serial murder in the western United States may be partially attributable to “a culture of casual predatory sexuality,” and differential access to vice facilities in Californian cities. Levin and Fox (1985, p. 64) refer to Southern California, with its wealth of displaced individuals and potential victims, as a “playground for murder.”
Table 6 displays a state-by-state (including the District of Columbia) comparison of estimated population, and murder and nonnegligent manslaughter offences and rates known to police, 1988 (Flanagan & Maguire, 1990, Table 3.120, pp. 367-375), cases of serial murder in which one or more victims were killed, 1795 to 1988 (Hickey 1991, Table 5.2, p. 78), serial murder victims by state, mid-1800s to 1989 (Cavanagh, 1993, Table 1), and location of serial killer operation, 1880 to 1993 (based on the present research). Table 7 shows the serial murder rates by state, adjusted for both population (per 10,000,000 people) and murder (per 1,000 offences).

<table>
<thead>
<tr>
<th>State</th>
<th>Population</th>
<th>Murders</th>
<th>Murder Rate</th>
<th>Hickey</th>
<th>Cavanagh</th>
<th>FBI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>4,127,000</td>
<td>408</td>
<td>9.89</td>
<td>8</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Alaska</td>
<td>513,000</td>
<td>29</td>
<td>5.65</td>
<td>3</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Arizona</td>
<td>3,466,000</td>
<td>294</td>
<td>8.48</td>
<td>3</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Arkansas</td>
<td>2,422,000</td>
<td>211</td>
<td>8.71</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>California</td>
<td>28,168,000</td>
<td>2,936</td>
<td>10.42</td>
<td>50</td>
<td>462</td>
<td>67</td>
</tr>
<tr>
<td>Colorado</td>
<td>3,290,000</td>
<td>187</td>
<td>5.68</td>
<td>8</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Connecticut</td>
<td>3,241,000</td>
<td>174</td>
<td>5.37</td>
<td>8</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Delaware</td>
<td>660,000</td>
<td>34</td>
<td>5.15</td>
<td>3</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>State</td>
<td>Population</td>
<td>Murders</td>
<td>Murder Rate</td>
<td>Hickey</td>
<td>Cavanagh</td>
<td>FBI</td>
</tr>
<tr>
<td>-------------</td>
<td>------------</td>
<td>---------</td>
<td>-------------</td>
<td>--------</td>
<td>----------</td>
<td>-----</td>
</tr>
<tr>
<td>DC</td>
<td>620,000</td>
<td>369</td>
<td>59.52</td>
<td>0</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Florida</td>
<td>12,377,000</td>
<td>1,416</td>
<td>11.44</td>
<td>20.5</td>
<td>98</td>
<td>24</td>
</tr>
<tr>
<td>Georgia</td>
<td>6,401,000</td>
<td>748</td>
<td>11.69</td>
<td>13</td>
<td>78</td>
<td>11</td>
</tr>
<tr>
<td>Hawaii</td>
<td>1,093,000</td>
<td>44</td>
<td>4.03</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Idaho</td>
<td>999,000</td>
<td>36</td>
<td>3.6</td>
<td>3</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Illinois</td>
<td>11,544,000</td>
<td>991</td>
<td>8.58</td>
<td>20.5</td>
<td>76</td>
<td>20</td>
</tr>
<tr>
<td>Indiana</td>
<td>5,575,000</td>
<td>358</td>
<td>6.42</td>
<td>8</td>
<td>26</td>
<td>6</td>
</tr>
<tr>
<td>Iowa</td>
<td>2,834,000</td>
<td>47</td>
<td>1.66</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Kansas</td>
<td>2,487,000</td>
<td>85</td>
<td>3.42</td>
<td>8</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Kentucky</td>
<td>3,721,000</td>
<td>229</td>
<td>6.15</td>
<td>8</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Louisiana</td>
<td>4,420,000</td>
<td>512</td>
<td>11.58</td>
<td>8</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>Maine</td>
<td>1,206,000</td>
<td>37</td>
<td>3.07</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Maryland</td>
<td>4,644,000</td>
<td>449</td>
<td>9.67</td>
<td>3</td>
<td>17</td>
<td>4</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>5,871,000</td>
<td>208</td>
<td>3.54</td>
<td>8</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Michigan</td>
<td>9,300,000</td>
<td>1,009</td>
<td>10.85</td>
<td>8</td>
<td>49</td>
<td>13</td>
</tr>
<tr>
<td>Minnesota</td>
<td>4,306,000</td>
<td>124</td>
<td>2.88</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Mississippi</td>
<td>2,627,000</td>
<td>225</td>
<td>8.56</td>
<td>3</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Missouri</td>
<td>5,139,000</td>
<td>413</td>
<td>8.04</td>
<td>3</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Montana</td>
<td>804,000</td>
<td>21</td>
<td>2.61</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>State</td>
<td>Population</td>
<td>Murders</td>
<td>Murder Rate</td>
<td>Hickey</td>
<td>Cavanagh</td>
<td>FBI</td>
</tr>
<tr>
<td>------------------</td>
<td>------------</td>
<td>---------</td>
<td>-------------</td>
<td>--------</td>
<td>----------</td>
<td>-----</td>
</tr>
<tr>
<td>Nebraska</td>
<td>1,601,000</td>
<td>58</td>
<td>3.62</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Nevada</td>
<td>1,060,000</td>
<td>111</td>
<td>10.47</td>
<td>3</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>1,097,000</td>
<td>25</td>
<td>2.28</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>New Jersey</td>
<td>7,720,000</td>
<td>411</td>
<td>5.32</td>
<td>8</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>New Mexico</td>
<td>1,510,000</td>
<td>173</td>
<td>11.46</td>
<td>3</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>New York</td>
<td>17,898,000</td>
<td>2,244</td>
<td>12.54</td>
<td>20.5</td>
<td>105</td>
<td>19</td>
</tr>
<tr>
<td>North Carolina</td>
<td>6,526,000</td>
<td>510</td>
<td>7.81</td>
<td>3</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>North Dakota</td>
<td>663,000</td>
<td>12</td>
<td>1.81</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ohio</td>
<td>10,872,000</td>
<td>585</td>
<td>5.38</td>
<td>13</td>
<td>76</td>
<td>9</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>3,263,000</td>
<td>243</td>
<td>7.45</td>
<td>8</td>
<td>21</td>
<td>6</td>
</tr>
<tr>
<td>Oregon</td>
<td>2,741,000</td>
<td>139</td>
<td>5.07</td>
<td>8</td>
<td>33</td>
<td>14</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>12,027,000</td>
<td>660</td>
<td>5.49</td>
<td>8</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>995,000</td>
<td>41</td>
<td>4.12</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>South Carolina</td>
<td>3,493,000</td>
<td>325</td>
<td>9.3</td>
<td>3</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>South Dakota</td>
<td>715,000</td>
<td>22</td>
<td>3.08</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Tennessee</td>
<td>4,919,000</td>
<td>461</td>
<td>9.37</td>
<td>8</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Texas</td>
<td>16,780,000</td>
<td>2,022</td>
<td>12.05</td>
<td>20.5</td>
<td>69</td>
<td>21</td>
</tr>
<tr>
<td>Utah</td>
<td>1,691,000</td>
<td>47</td>
<td>2.78</td>
<td>8</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Vermont</td>
<td>556,000</td>
<td>11</td>
<td>1.98</td>
<td>3</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>State</td>
<td>Population</td>
<td>Murders</td>
<td>Murder Rate</td>
<td>Hickey</td>
<td>Cavanagh</td>
<td>FBI</td>
</tr>
<tr>
<td>---------------</td>
<td>------------</td>
<td>---------</td>
<td>-------------</td>
<td>--------</td>
<td>----------</td>
<td>-----</td>
</tr>
<tr>
<td>Virginia</td>
<td>5,996,000</td>
<td>468</td>
<td>7.81</td>
<td>8</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Washington</td>
<td>4,619,000</td>
<td>264</td>
<td>5.72</td>
<td>8</td>
<td>50</td>
<td>12</td>
</tr>
<tr>
<td>West Virginia</td>
<td>1,884,000</td>
<td>93</td>
<td>4.94</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>4,858,000</td>
<td>144</td>
<td>2.96</td>
<td>3</td>
<td>19</td>
<td>9</td>
</tr>
<tr>
<td>Wyoming</td>
<td>471,000</td>
<td>12</td>
<td>2.55</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>United States</td>
<td>245,810,000</td>
<td>20,675</td>
<td>8.41</td>
<td>363</td>
<td>1,424</td>
<td>378</td>
</tr>
<tr>
<td>Mean</td>
<td>4,820,000</td>
<td>405.39</td>
<td>8.41</td>
<td>7.12</td>
<td>27.92</td>
<td>7.41</td>
</tr>
</tbody>
</table>

Table 6. Serial Murder Figures by State.

<table>
<thead>
<tr>
<th>Study</th>
<th>Hickey</th>
<th>Cavanagh</th>
<th>FBI</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td>Rate</td>
<td>Per Murder</td>
<td>Rate</td>
</tr>
<tr>
<td>Alabama</td>
<td>19.38</td>
<td>19.61</td>
<td>19.38</td>
</tr>
<tr>
<td>Alaska</td>
<td>58.48</td>
<td>103.45</td>
<td>272.9</td>
</tr>
<tr>
<td>Arizona</td>
<td>8.66</td>
<td>10.2</td>
<td>28.85</td>
</tr>
<tr>
<td>California</td>
<td>17.75</td>
<td>17.03</td>
<td>164.02</td>
</tr>
<tr>
<td>Colorado</td>
<td>24.32</td>
<td>42.78</td>
<td>12.16</td>
</tr>
</tbody>
</table>

239
<table>
<thead>
<tr>
<th>State</th>
<th>Study</th>
<th>Hickey Rate</th>
<th>Per Murder</th>
<th>Cavanagh Rate</th>
<th>Per Murder</th>
<th>FBI Rate</th>
<th>Per Murder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecticut</td>
<td></td>
<td>24.68</td>
<td>45.98</td>
<td>40.11</td>
<td>74.71</td>
<td>9.26</td>
<td>17.24</td>
</tr>
<tr>
<td>Delaware</td>
<td></td>
<td>45.45</td>
<td>88.24</td>
<td>75.76</td>
<td>147.06</td>
<td>15.15</td>
<td>29.41</td>
</tr>
<tr>
<td>DC</td>
<td></td>
<td>0</td>
<td>0</td>
<td>161.29</td>
<td>27.1</td>
<td>32.26</td>
<td>5.42</td>
</tr>
<tr>
<td>Florida</td>
<td></td>
<td>16.56</td>
<td>14.48</td>
<td>79.18</td>
<td>69.21</td>
<td>19.39</td>
<td>16.95</td>
</tr>
<tr>
<td>Georgia</td>
<td></td>
<td>20.31</td>
<td>17.38</td>
<td>121.86</td>
<td>104.28</td>
<td>17.18</td>
<td>14.71</td>
</tr>
<tr>
<td>Hawaii</td>
<td></td>
<td>0</td>
<td>0</td>
<td>45.75</td>
<td>113.64</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Idaho</td>
<td></td>
<td>30.03</td>
<td>83.33</td>
<td>80.08</td>
<td>222.22</td>
<td>40.04</td>
<td>111.11</td>
</tr>
<tr>
<td>Illinois</td>
<td></td>
<td>17.76</td>
<td>20.69</td>
<td>65.84</td>
<td>76.69</td>
<td>17.33</td>
<td>20.18</td>
</tr>
<tr>
<td>Indiana</td>
<td></td>
<td>14.35</td>
<td>22.35</td>
<td>46.64</td>
<td>72.63</td>
<td>10.76</td>
<td>16.76</td>
</tr>
<tr>
<td>Iowa</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7.06</td>
<td>42.55</td>
</tr>
<tr>
<td>Kansas</td>
<td></td>
<td>32.17</td>
<td>94.12</td>
<td>4.02</td>
<td>11.76</td>
<td>20.1</td>
<td>58.82</td>
</tr>
<tr>
<td>Kentucky</td>
<td></td>
<td>21.5</td>
<td>34.93</td>
<td>10.75</td>
<td>17.47</td>
<td>10.75</td>
<td>17.47</td>
</tr>
<tr>
<td>Louisiana</td>
<td></td>
<td>18.1</td>
<td>15.63</td>
<td>67.87</td>
<td>58.59</td>
<td>9.05</td>
<td>7.81</td>
</tr>
<tr>
<td>Maine</td>
<td></td>
<td>0</td>
<td>0</td>
<td>8.29</td>
<td>27.03</td>
<td>8.29</td>
<td>27.03</td>
</tr>
<tr>
<td>Maryland</td>
<td></td>
<td>6.46</td>
<td>6.68</td>
<td>36.61</td>
<td>37.86</td>
<td>8.61</td>
<td>8.91</td>
</tr>
<tr>
<td>Massachusetts</td>
<td></td>
<td>13.63</td>
<td>38.46</td>
<td>5.11</td>
<td>14.42</td>
<td>6.81</td>
<td>19.23</td>
</tr>
<tr>
<td>Michigan</td>
<td></td>
<td>8.6</td>
<td>7.93</td>
<td>52.69</td>
<td>48.56</td>
<td>13.98</td>
<td>12.88</td>
</tr>
<tr>
<td>Minnesota</td>
<td></td>
<td>6.97</td>
<td>24.19</td>
<td>0</td>
<td>0</td>
<td>6.97</td>
<td>24.19</td>
</tr>
<tr>
<td>Study</td>
<td>Hickey</td>
<td>Cavanagh</td>
<td>FBI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>----------</td>
<td>----------</td>
<td>------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rate</td>
<td>Per Murder</td>
<td>Rate</td>
<td>Per Murder</td>
<td>Rate</td>
<td>Per Murder</td>
<td></td>
</tr>
<tr>
<td>Mississippi</td>
<td>11.42</td>
<td>13.33</td>
<td>26.65</td>
<td>31.11</td>
<td>11.42</td>
<td>13.33</td>
<td></td>
</tr>
<tr>
<td>Missouri</td>
<td>5.84</td>
<td>7.26</td>
<td>27.24</td>
<td>33.9</td>
<td>11.68</td>
<td>14.53</td>
<td></td>
</tr>
<tr>
<td>Montana</td>
<td>37.31</td>
<td>142.86</td>
<td>49.75</td>
<td>190.48</td>
<td>12.44</td>
<td>47.62</td>
<td></td>
</tr>
<tr>
<td>Nebraska</td>
<td>18.74</td>
<td>51.72</td>
<td>24.98</td>
<td>68.97</td>
<td>6.25</td>
<td>17.24</td>
<td></td>
</tr>
<tr>
<td>Nevada</td>
<td>28.3</td>
<td>27.03</td>
<td>84.91</td>
<td>81.08</td>
<td>132.08</td>
<td>126.13</td>
<td></td>
</tr>
<tr>
<td>New Hampshire</td>
<td>27.35</td>
<td>120</td>
<td>0</td>
<td>0</td>
<td>9.12</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>New Jersey</td>
<td>10.36</td>
<td>19.46</td>
<td>18.13</td>
<td>34.06</td>
<td>7.77</td>
<td>14.6</td>
<td></td>
</tr>
<tr>
<td>New Mexico</td>
<td>19.87</td>
<td>17.34</td>
<td>39.74</td>
<td>34.68</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>New York</td>
<td>11.45</td>
<td>9.14</td>
<td>58.67</td>
<td>46.79</td>
<td>10.62</td>
<td>8.47</td>
<td></td>
</tr>
<tr>
<td>North Carolina</td>
<td>4.6</td>
<td>5.88</td>
<td>19.92</td>
<td>25.49</td>
<td>3.06</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>North Dakota</td>
<td>45.25</td>
<td>250</td>
<td>15.08</td>
<td>83.33</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ohio</td>
<td>11.96</td>
<td>22.22</td>
<td>69.9</td>
<td>129.91</td>
<td>8.28</td>
<td>15.38</td>
<td></td>
</tr>
<tr>
<td>Oklahoma</td>
<td>24.52</td>
<td>32.92</td>
<td>64.36</td>
<td>86.42</td>
<td>18.39</td>
<td>24.69</td>
<td></td>
</tr>
<tr>
<td>Oregon</td>
<td>29.19</td>
<td>57.55</td>
<td>120.39</td>
<td>237.41</td>
<td>51.08</td>
<td>100.72</td>
<td></td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>6.65</td>
<td>12.12</td>
<td>16.63</td>
<td>30.3</td>
<td>8.31</td>
<td>15.15</td>
<td></td>
</tr>
<tr>
<td>Rhode Island</td>
<td>30.15</td>
<td>73.17</td>
<td>0</td>
<td>0</td>
<td>30.15</td>
<td>73.17</td>
<td></td>
</tr>
<tr>
<td>South Carolina</td>
<td>8.59</td>
<td>9.23</td>
<td>14.31</td>
<td>15.38</td>
<td>17.18</td>
<td>18.46</td>
<td></td>
</tr>
<tr>
<td>South Dakota</td>
<td>41.96</td>
<td>136.36</td>
<td>0</td>
<td>0</td>
<td>13.99</td>
<td>45.45</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Hickey Rate</td>
<td>Hickey Per Murder</td>
<td>Cavanagh Rate</td>
<td>Cavanagh Per Murder</td>
<td>FBI Rate</td>
<td>FBI Per Murder</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>------------------</td>
<td>---------------</td>
<td>---------------------</td>
<td>----------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>State</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tennessee</td>
<td>16.26</td>
<td>17.35</td>
<td>14.23</td>
<td>15.18</td>
<td>10.16</td>
<td>10.85</td>
<td></td>
</tr>
<tr>
<td>Texas</td>
<td>12.22</td>
<td>10.14</td>
<td>41.12</td>
<td>34.12</td>
<td>12.51</td>
<td>10.39</td>
<td></td>
</tr>
<tr>
<td>Utah</td>
<td>47.31</td>
<td>170.21</td>
<td>82.79</td>
<td>297.87</td>
<td>70.96</td>
<td>255.32</td>
<td></td>
</tr>
<tr>
<td>Vermont</td>
<td>53.96</td>
<td>272.73</td>
<td>71.94</td>
<td>363.64</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Virginia</td>
<td>13.34</td>
<td>17.09</td>
<td>8.34</td>
<td>10.68</td>
<td>13.34</td>
<td>17.09</td>
<td></td>
</tr>
<tr>
<td>Washington</td>
<td>17.32</td>
<td>30.3</td>
<td>108.25</td>
<td>189.39</td>
<td>25.98</td>
<td>45.45</td>
<td></td>
</tr>
<tr>
<td>West Virginia</td>
<td>15.92</td>
<td>32.26</td>
<td>5.31</td>
<td>10.75</td>
<td>10.62</td>
<td>21.51</td>
<td></td>
</tr>
<tr>
<td>Wisconsin</td>
<td>6.18</td>
<td>20.83</td>
<td>39.11</td>
<td>131.94</td>
<td>18.53</td>
<td>62.5</td>
<td></td>
</tr>
<tr>
<td>Wyoming</td>
<td>63.69</td>
<td>250</td>
<td>0</td>
<td>0</td>
<td>63.69</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>14.77</td>
<td>17.56</td>
<td>57.93</td>
<td>68.88</td>
<td>15.38</td>
<td>18.28</td>
<td></td>
</tr>
</tbody>
</table>

Table 7. Serial Murder Rates by State.

The states with the highest frequencies of serial murder (more than twice the mean) were California (Hickey, Cavanagh, FBI), Florida (Hickey, Cavanagh,
FBI), New York (Hickey, Cavanagh, FBI), Texas (Hickey, Cavanagh, FBI), Illinois (Hickey, Cavanagh, FBI), Georgia (Cavanagh), and Ohio (Cavanagh).

The states with the highest per capita rates of serial murder (more than twice the overall rate for the United States) were Alaska (Hickey, Cavanagh, FBI), Oregon (Cavanagh, FBI), Idaho (Hickey, FBI), Wyoming (Hickey, FBI), Utah (Hickey, FBI), Nevada (FBI), Montana (Hickey), Colorado (FBI), California (Cavanagh), Georgia (Cavanagh), North Dakota (Hickey), South Dakota (Hickey), Kansas (Hickey), Delaware (Hickey), Vermont (Hickey), Rhode Island (Hickey), and the District of Columbia (Cavanagh, FBI).

The states with the highest rates of serial murder per all murder (more than twice the overall rate for the United States) were Alaska (Hickey, Cavanagh, FBI), Utah (Hickey, Cavanagh, FBI), Idaho (Hickey, Cavanagh, FBI), Oregon (Hickey, Cavanagh, FBI), Montana (Hickey, Cavanagh, FBI), Washington (Cavanagh, FBI), Wyoming (Hickey, FBI), Vermont (Hickey, Cavanagh), Colorado (Hickey, FBI), South Dakota (Hickey, FBI), Kansas (Hickey, FBI), Delaware (Hickey, Cavanagh), New Hampshire (Hickey, FBI), Wisconsin (FBI), Nevada (FBI), California (Cavanagh), North Dakota (Hickey), Iowa (FBI), Connecticut (Hickey), Nebraska (Hickey), Massachusetts (Hickey), and Rhode Island (Hickey).
The degree of confidence in these findings should be tempered by the fact that each study used somewhat different methods of counting, and covered unlike time periods. Furthermore, many states had only recorded small numbers of serial murder cases and therefore little reliability should be placed in their ranking. Of those states with the highest per capita rates, only Oregon, Utah, California, and Georgia had counts in all three studies of five or more cases. Of those states with the highest per murder rates, only Oregon, Utah, Washington, and California had counts in all three studies of five or more cases. Once population or overall murder levels (a proxy for both population and propensity for lethal violence) are accounted for, many of the geographic differences noted by previous researchers disappear. There is still some evidence, however, for the existence of a western regional variation.

70 An additional complication results from the fact that Hickey presents his frequency counts in ranges (e.g., Oregon, 6 to 10 cases). The midpoint of the range was used in the above comparison (e.g., Oregon, 8 cases).
Microlevel Analysis

Case Descriptions and Maps

Of the 19 serial murder cases produced from the previously described sampling procedure, 10 were selected for more detailed analysis: (1) Richard Chase; (2) Albert DeSalvo; (3) Clifford Olson; (4) Angelo Buono and Kenneth Bianchi; (5) Peter Sutcliffe; (6) Richard Ramirez; (7) David Berkowitz; (8) Jeffrey Dahmer; (9) Joel Rifkin; and (10) John Collins. In order to explore the impact of violating certain selection criteria, an additional 3 cases were included: (1) Aileen Wuornos; (2) Ian Brady and Myra Hindley; and (3) Jerry Brudos. These 13 cases, representing 15 serial murderers, 178 victims, and 347 crime locations, comprise the microlevel data set.

Summary histories for each of the selected murder series follow. Each case synopsis is accompanied by a graph of the crime site point pattern, a CGT isopleth map, and a CGT choropleth map. The point pattern graphs show the relative locations of victim encounter sites, body dump sites, and offender residence(s). In certain cases vehicle drop or separate murder sites were also known to the police,

71 These three cases were randomly selected from those that met the information criteria.
and these locations are marked as well. A location was only marked once regardless of the number of crimes occurring there. For the purposes of this study, a victim and the associated crime sites were connected to a serial killer case if the offence was one of murder, attempted murder, or a violent crime (rape, sexual assault, kidnapping, abduction, or any attempt thereof), the circumstances of which were such that the victim had a substantial likelihood of being killed.

While workplace is an important component of activity space, consistently reliable information on occupation could not be obtained for this sample of offenders and therefore work sites are not analyzed in the present study. If a certain location appeared to be a key anchor point for the serial killer, however, it is indicated. Both residences are marked in those cases involving two offenders, or those where an offender moved in the midst of the murder series. In some instances a crime occurred a significant distance from the others and could not properly be shown on the same map as the other crime sites. Such omissions are detailed in the applicable case discussion.

The graphs are scaled in kilometres and oriented with north as up. The scales are relative only, and do not indicate any absolute referencing system. The isopleth maps show a variety of analyses (not necessarily the most optimal) derived from different crime site types. The choropleth maps are based on the
same crime site types as the isopleth maps. The isopleth and choropleth map coordinates are arbitrary and show direction and relative distance only.

Richard Chase

Richard Trenton Chase, the Vampire Killer, was a chronic paranoid schizophrenic who believed that his blood supply was being dried up by aliens (Biondi & Hecox, 1992; Ressler & Shachtman, 1992). Therefore he reasoned, the only way he could stay alive was by drinking the blood of others. Released from a mental institution in 1976, Chase began a rampage of murder in Sacramento County, California, in late December of 1977.

He killed six people, male and female, adult and child, engaging in postmortem evisceration, anthropophagy, and vampirism. Often used as an exemplar for the disorganized murderer type, Chase lived in the area of his crimes, at one point leaving a vehicle stolen from one of his victims just around the corner from his home. Apprehended in January 1978 through police neighbourhood canvassing efforts that were informed by a psychological profile, Chase was eventually convicted of six counts of first-degree murder. He committed suicide by poison in 1980 while in prison.
The graph of the crime site point pattern for Richard Chase is presented in Figure 10. Consistent with a disorganized murder series, the hunting area is localized and limited in size. With one exception, the body dump and encounter sites are equivalent. The last crime scene involved four victims. The isopleth map (all sites) for this case is presented in Figure 11, and the choropleth map in Figure 12.

Albert DeSalvo

Albert DeSalvo, the Boston Strangler, murdered 13 women during the 1960s in and around Boston, Massachusetts (Frank, 1966; James, 1991; Newton, 1990a; Time-Life, 1992b). Married, with a family, he had a particularly abusive family history and was eventually diagnosed as schizophrenic. DeSalvo is believed to have committed over 300 sexual assaults and hundreds of break-ins in four states both before and after his murders. He began to strangle his victims in June 1962, often leaving their bodies displayed with an elaborate bow tied in the ligatures around their necks.

DeSalvo would commute into Boston from his home in Malden and drive aimlessly through rundown and "Bohemian" neighbourhoods in the Back Bay

251
area. He would eventually pick a target location from those types of buildings likely to house students, transients, or the elderly. DeSalvo was often familiar with these places from his travels over the city to work at different sites as a maintenance man for a construction company. He would con his way into the victim's apartment by pretending to be the building plumber. A Medical-Psychiatric Committee had mistakenly profiled his crimes as the product of two separate individuals, in part because DeSalvo altered his choice of victims, first killing elderly women, and then younger females.

His final victim, killed on January 4, 1964, was left with a card reading "Happy New Year" by her feet. DeSalvo then returned to sexual assaults, and was eventually arrested and jailed for rape. While confined to the state psychiatric hospital he confessed to, but was never tried for, the Boston stranglings. He died in 1973 after being stabbed during a prison fight.

The graph of the crime site point pattern for Albert DeSalvo is presented in Figure 13. Body dump and encounter sites are equivalent. It can be seen from the graph that while DeSalvo's residence was located within his hunting area, he was really a poacher who did not search for victims close to home. The isopleth map (body dump sites) for this case is presented in Figure 14, and the choropleth map in Figure 15.
Clifford Olson

From November 1980 to July 1981, 11 children disappeared from the Greater Vancouver area of British Columbia (Alston, 1994; Bayless, 1982; Ferry & Inwood, 1982; Mulgrew, 1990; Olson, 1989, 1992a, 1992b; Worthington, 1993). The remains of most of these victims were not discovered until Clifford Robert Olson confessed to their murders after his arrest by an RCMP surveillance team.

A petty but chronic offender, Olson, 41, spent only four years of his adult life out of prison. When he began his murder orgy he was free on bail for sex and firearms charges, and was wanted for child abuse charges in Nova Scotia, though the warrant was not enforceable outside that province (see Rossmo, 1987). While in the B.C. Penitentiary he learned his future modus operandi from the letters and maps of fellow convict Gary Francis Marcoux, a brutal rapist and child killer.

A veteran con man, Olson would pick up his victims from suburban shopping malls, arcades, and bus stops, luring them into his car with flashy business cards and promises of employment. Some he let go, others he murdered. His victims were of both sexes and ranged in age from 9 to 18; Olson’s main selection criterion appeared to be victim vulnerability. He would drive extensively
in his hunt for prey and once, in just two weeks during July 1981, put 5,569 kilometres on a rental car.

One of the most controversial aspects of the case was the agreement by the Attorney General of British Columbia to pay Olson $100,000 in exchange for information about the locations of his victims' burial sites. Though this "cash-for-bodies" deal generated considerable reaction at the time, the resulting evidence was necessary in order to convict Olson of the multiple homicides. Sentenced to life imprisonment on 11 counts of first-degree murder (although eligible for a judicial review on August 12, 1996, under s. 745 of the Criminal Code of Canada), Olson still ranks as Canada's most prolific serial killer.

The graph of the crime site point pattern for Clifford Olson's victim encounter locations is presented in Figure 16, and the graph of his body dump sites in Figure 17. Olson moved early in his murder series and it is likely that the second residence (the northernmost marked on the graph) was his main anchor point. Not only did he reside there for most of the murders but he had lived in that particular neighbourhood several times in the past. The graph also shows the location of Agassiz Mountain Prison.

It appears that Olson had two mental maps, one used in his search for victims, the other in his choice of dump sites. The first of these was local and
Figure 16. Crime Site Point Pattern - Clifford Olson (Victim Encounter Sites).
Figure 18. Isopleth Map – Clifford Olson (Victim Encounter Sites).
Figure 19. Choropleth Map - Clifford Olson (Victim Encounter Sites).
centred on his residence and surrounding neighbourhood, while the second was regional and focused on Mountain Prison. The body dump site area is much larger than the victim encounter site area. Olson was willing to travel greater distances to dispose of victims than to search for them – the former was an infrequent and risky event, the latter common and relatively safe. The isopleth map (victim encounter sites) for this case is presented in Figure 18, and the choropleth map in Figure 19.

Angelo Buono and Kenneth Bianchi

The Hillside Stranglers, Angelo Buono and Kenneth Bianchi, were cousins who ran a part-time prostitution ring (Gates & Shah, 1992; Levin & Fox, 1985; Newton, 1990a; Newton & Swoope, 1987; O’Brien, 1985; Schwarz, 1981; Time-Life, 1993; Wolf & Mader, 1986). When that enterprise failed they began to pick up women from the streets of Los Angeles, by impersonating police officers, to bring back to Buono’s automobile upholstery shop-cum-residence. There the victims were sexually assaulted and tortured before being murdered. Their bodies were later dumped on the hillsides of the San Gabriel Range.
These dump sites were usually chosen by Angelo Buono, the more dominant of the pair of killers. He had grown up in the suburb of Glendale and knew the Los Angeles area well, unlike Bianchi who was raised in Rochester, New York. The crime locations produced a connected geographic pattern that was subsequently linked to Buono’s home, and this fact was presented as corroborating evidence by the prosecution during trial. “The Stranglers were taking advantage of the freeways, covering far more territory than would have been possible in, say, New York or Boston, sketching the arterial form of the city in the geographical pattern of their abductions and dumpings” (O’Brien, 1985, p. 179).

Buono and Bianchi murdered a total of 10 women from 1977 to 1978, before they separated and Bianchi moved to the state of Washington. There he killed two more women in January 1979 before being arrested by Bellingham Police, who subsequently made the connection between their case and the Hillside Stranglings. Bianchi at first pretended to suffer from multiple personality disorder, and his alter ego “Steve” claimed responsibility for the murders. When this ruse was unsuccessful he testified against his cousin, and after the longest trial in California history, both killers were sentenced to life imprisonment.

The graph of the crime site point pattern for Angelo Buono and Kenneth Bianchi is presented in Figure 20. The Bellingham murders are not shown on the
Figure 20. Crime Site Point Pattern – Angelo Buono and Kenneth Bianchi.
Figure 21. Isopleth Map - Angelo Buono and Kenneth Bianchi (All Sites).
Peter Sutcliffe

In the 5 years from 1975 to 1980 the Yorkshire Ripper attacked 20 women in Northern England, murdering 13 of them (Burn, 1984; Canter, 1994; Doney, 1990; James, 1992; Jones, 1989; "The killing ground," 1981; Kind, 1987a, 1987b; Newton, 1990a; Nicholson, 1979; Time-Life, 1993). Like Jack the Ripper, his namesake of a century past, Peter Sutcliffe sought out his victims from the prostitutes who worked the streets and bars of red-light districts. They were attacked in a frenzied fury and murdered with a claw hammer or sharpened screwdriver.

The Ripper Inquiry was one of the most massive manhunts in British history, consuming enormous police resources and costing millions of dollars. Ironically, Sutcliffe was interviewed by detectives at least 9 different times, a connection lost in the 24 tons of paper records generated by the investigation. When the police presence became too great in the red-light districts of West
Yorkshire, Sutcliffe responded by hunting in other cities and by attacking women who did not work the streets. Sutcliffe was eventually arrested while parked with a prostitute in Sheffield by two patrol officers who found his murder weapons.

Sutcliffe confessed and claimed to be acting on orders from God whose voice he had heard originating from a gravestone. This led to considerable debate amongst psychiatrists over whether Sutcliffe was a paranoid schizophrenic or a sexual sadist. One doctor assessed him as an extremely dangerous person, and conjectured that the best forensic hospitalization could hope to accomplish was to turn him into just a dangerous one. Sutcliffe's own explanation to his brother for his murderous actions was that he was only cleaning up the streets. The case of Regina v. Sutcliffe in the Old Bailey resulted in 13 majority verdicts of guilty, and a life sentence without hope of parole for 30 years.

The graph of the crime site point pattern for Peter Sutcliffe is presented in Figure 23. Most of his victims were prostitutes and therefore the target backcloth was not uniform. Body dump and encounter sites are almost equivalent. Sutcliffe moved halfway through the murder series (to the northernmost residence marked on the graph). The isopleth map (body dump sites) for this case is presented in Figure 24, and the choropleth map in Figure 25.
Figure 23. Crime Site Point Pattern – Peter Sutcliffe.
Figure 24. Isopleth Map - Peter Sutcliffe (Body Dump Sites).
Richard Ramirez

Greater Los Angeles was terrorized for over a year by the Night Stalker, 25-year-old Richard Leyva Ramirez (Allen, 1993; Linedecker, 1991; Lyman, 1993; Newton, 1990a; Time-Life, 1992b). From 1984 to 1985 he murdered at least 15 people, tried to kill 8 others, and sexually assaulted another 10. His preferred modus operandi was to shoot his victims in the head but he also slashed their throats and brutally beat them to death.

An unemployed skid road habitué, he hunted at night in the middle-class, suburban neighbourhoods of the San Gabriel and San Fernando Valleys, breaking into the homes of his sleeping victims. For some unknown reason, Ramirez seemed to target single-storey houses painted in light, pastel colours (usually white, yellow, or beige), and most often located near freeway off-ramps.72

The Night Stalker was identified through old-fashioned witness observation and good patrol work, combined with state-of-the-art fingerprinting technology

---

72 The Night Stalker’s selection of targets close to freeway exits can be explained as opportunism (i.e., those were the first suitable houses encountered by Ramirez), or tactical consideration (i.e., those houses were never far from escape routes). It could also be argued that little of the Los Angeles metropolitan area is any significant distance from one freeway or another.
involving cyanoacrylate resin fuming, laser enhancement, and a computerized digital image search system. Ramirez was then apprehended after a lengthy chase through the East Los Angeles barrio by citizens who recognized his mug shot from the newspaper.

Claiming to be a follower of Satan, he raved to the courtroom after his guilty verdict: “You don’t understand me. You are not expected to. You are not capable of it” (Linedecker, 1991, p. 287). Some experts described Ramirez’s crimes as simply pure evil. He was sentenced to the gas chamber, and now has a fan club of devoted Night Stalker “groupies” who regularly visit him on San Quentin’s death row.

The graph of the crime site point pattern for Richard Ramirez is presented in Figure 26. Body dump and encounter sites are equivalent. Several of the crime sites involved two victims, and one of these occurred in San Francisco (not plotted on the graph). The isopleth map (body dump sites) for this case is presented in Figure 27, and the choropleth map in Figure 28.
Figure 26. Crime Site Point Pattern - Richard Ramirez.
Figure 28. Choropleth Map - Richard Ramirez (Body Dump Sites).
David Berkowitz

From the summer of 1976 to the summer of 1977 David Berkowitz shot 10 victims with a .44-calibre revolver, killing 6 of them (Carpozi, Jr., 1977; Lane & Gregg, 1992; Newton, 1990a; “Murder and attempted murders,” 1977; Terry, 1987; Time-Life Books, 1992b). Known as the Son of Sam from a phrase in one of the taunting letters he sent to police and New York tabloids, Berkowitz would later claim to be obeying the murderous orders of a demon, manifested in the form of the dog belonging to his neighbour, Sam Carr.

Berkowitz hunted almost nightly through the New York boroughs of Queens, Brooklyn, and the Bronx, often returning to the scenes of his former crimes. He sought out couples in parked cars, appearing to be attracted to women with long, dark, wavy hair. In a message left for police at one of the shooting sites, he wrote, “I love to hunt. Prowling the streets looking for fair game – tasty meat. The wemon of Queens are z prettyist of all. I must be the water they drink. I live for the hunt – my life. Blood for Papa....” (uncorrected, Terry, 1987, p. 55).

Acting on information from a witness who had seen the killer remove a summons from his illegally parked Ford Galaxie sedan shortly after the last shooting, police arrested Berkowitz at his Yonkers home. He pled guilty after being found sane. In 1979, while serving his murder sentence in Attica Prison,
Berkowitz admitted that he had concocted the Son of Sam story though some psychiatrists remain dubious about his recantation. While controversy remains over whether or not Berkowitz was a paranoid schizophrenic who suffered from delusions, no one can deny his self-diagnosis. During his pretrial evaluation, Berkowitz drew a sketch of a jailed man surrounded by numerous walls. At the bottom he wrote, in classic understatement, “I am not well. Not at all” (Time-Life Books, 1992b, p. 183).

The graph of the crime site point pattern for David Berkowitz is presented in Figure 29. Body dump and encounter sites are equivalent. Several of the crime sites involved two victims. Berkowitz moved from the Bronx after his first two attacks to Yonkers (the northernmost residence marked on the graph), an address situated outside of his hunting area. At that point he became a poacher, commuting into the boroughs of New York City to commit his shootings. Berkowitz grew up in the Bronx, however, and it appears that his victim searches were based on the mental map developed from that time. The isopleth map (body dump sites) for this case is presented in Figure 30, and the choropleth map in Figure 31.
Figure 29. Crime Site Point Pattern – David Berkowitz.
Figure 30. Isoleth Map – David Berkowitz (Body Dump Sites).
Figure 31. Choropleth Map - David Berkowitz (Body Dump Sites).
Perhaps the most infamous of recent serial killers, Jeffrey Dahmer admitted to police that he had murdered 17 men from 1978 to 1991 (Dahmer, 1994; Dvorchak & Holewa, 1991; Masters, 1993; Norris, 1992b). All but one of his victims were killed in the four-year period from 1987 to 1991 while Dahmer worked night shift as a mixer for the Ambrosia Chocolate Company. Unlike many serial killers, Dahmer did not own a vehicle and would usually travel by bus or taxi.

Dahmer most often preyed upon homosexual men that he picked up in the gay bars along South 2nd Street in Milwaukee, Wisconsin. They would be taken back to his place, drugged, and strangled. Dahmer would then engage in necrophilia, mutilation, and cannibalism. The corpses were dismembered and decapitated, and the body parts stored in the kitchen refrigerator or a 57-gallon barrel. Earlier attempts to create zombies from his victims by drilling holes in their heads and pouring acid inside had failed. Dahmer then began to boil the flesh from his victims' skulls as part of a plan to create an elaborate shrine of death. When one of his prospective victims escaped, police discovered the hideous remains inside Dahmer's apartment and arrested him. He subsequently confessed.
Determined by the court to be sane (in the legal sense), and found guilty of 16 counts of murder, Dahmer received the mandatory sentence of life imprisonment. The judge consecutively structured Dahmer's parole eligibility so as to forever prevent his release, but ultimately it did not matter. In November 1994, Dahmer was beaten to death by a fellow inmate in the maximum-security Columbia Correctional Institution.

The graph of the crime site point pattern for Jeffrey Dahmer is presented in Figure 32. The first murder took place at his childhood home in Ohio (not shown on the graph). The next three murders occurred while Dahmer was living with his grandmother in West Allis, a suburb of Milwaukee (the grandmother's home is not shown on the graph). He then moved out on his own to first one, and then a second apartment in Milwaukee. With the exception of the fifth murder, all the rest of the killings happened in his last apartment (the northernmost residence marked on the graph). As Dahmer picked up most of his victims from gay bars, the target backcloth was nonuniform. Two of his victims were encountered in Chicago (these sites are not shown on the graph). Dahmer was an ambusher and the bodies of his victims were kept in his apartment. The isopleth map (victim encounter sites) for this case is presented in Figure 33, and the choropleth map in Figure 34.
Figure 32. Crime Site Point Pattern - Jeffrey Dahmer.
Figure 33. Isopleth Map – Jeffrey Dahmer (Victim Encounter Sites).
Joel Rifkin

Joel Rifkin murdered New York street prostitutes, picking them up in Lower Manhattan, strangling them, and then disposing of their remains in isolated locations (Eftimiades, 1993; Pulitzer & Swirsky, 1994a, 1994b). From 1989 to 1993 he killed at least 17 times. Rifkin had very specific victim selection criteria, preferring women who reminded him of the high school girls he knew during the 1970s. His murdered victims were dumped, often in 55-gallon oil drums, over a vast area including such places as Long Island, the rivers of New York City, New Jersey, and upstate New York. For the most part police did not connect the deaths and disappearances of Rifkin's victims, partly because of the high risk nature of their occupations, and partly because of the method of body disposal.

Rifkin was arrested after a police chase that began when state troopers tried to stop him when they noticed his vehicle did not have a licence plate. They then discovered the decomposing body of his last victim under a tarpaulin in the rear of his pickup truck. During subsequent police interviews he confessed to a total of 17 murders. Rifkin was found guilty after an unsuccessful insanity defence and sentenced to 25 years to life imprisonment. While in jail he wrote, “The Catch 22 of life, if you know you’re crazy, then you’re not” (Pulitzer & Swirsky, 1994b, p. 300).
Figure 35. Crime Site Point Pattern - Joel Rifkin.
Figure 36. Isopleth Map – Joel Rifkin (Body Dump Sites).
Figure 37. Choropleth Map – Joel Rifkin (Body Dump Sites).
The graph of the crime site point pattern for Joel Rifkin is presented in Figure 35. The last victim dump site was marked according to the intended location. Rifkin commuted from Long Island into New York City where he picked up his prostitute victims. The target backcloth for his encounter sites was therefore nonuniform as was, to a lesser extent, that for his body dump sites. The former was constrained by the location of the red-light strolls, and the latter by the geography of the coast line and the degree of urban development. The isopleth map (body dump sites) for this case is presented in Figure 36, and the choropleth map in Figure 37.

John Collins

John Norman Collins preyed on coeds near the Eastern Michigan University (EMU) in Ypsilanti and was responsible for the Michigan Murders from 1967 to 1969 (James, 1991; Keyes, 1976; Lane & Gregg, 1992; Newton, 1990a). A senior EMU student himself, Collins worked one summer in the administration building and had lived at the Theta Chi fraternity house close to campus. His lifestyle thus made him familiar with both his victims and his hunting ground.
Collins would pick up hitchhiking female students, sexually assault, and then strangle, shoot, stab, or beat them to death. Their decomposed bodies were found dumped on the outskirts of Ypsilanti and neighbouring Ann Arbor. He is believed to be responsible for a total of eight murders. Suspicions about Collins were confirmed through crime scene forensics when he strangled his last victim in the home of his uncle, a Michigan state trooper.

Collins was fascinated by the novel Crime and Punishment. In an English essay he once wrote, “It’s not society’s judgment that’s important, but the individual’s own choice of will and intellect” (Keyes, 1976, p. 249), paraphrasing Dostoevsky’s student murderer Raskolnikov who believed that some men have an absolute right to commit wicked and criminal acts. On August 19, 1970, the jury returned with a verdict of guilty, and Collins was sentenced to confinement and hard labour for life in the Southern Michigan State Prison. Obviously he was not one of those men who Raskolnikov thought stood outside the law.

The graph of the crime site point pattern for John Collins is presented in Figure 38. Marked on the graph are three separate murder sites which were known to the police during their investigation. Collins committed one murder while on vacation in California (not shown on the graph). Also indicated is the location of Eastern Michigan University which may have been his primary anchor point. The
Figure 38. Crime Site Point Pattern – John Collins.
Figure 40. Choropleth Map – John Collins (All Sites).
area north of EMU is largely undeveloped land. The target backcloth for the body dump sites was not uniform as Collins chose isolated areas in which to dispose of his victims. The isopleth map (all sites) for this case is presented in Figure 39, and the choropleth map in Figure 40.

_Aileen Wuornos_

Aileen Wuornos murdered 7 men across central Florida in under 12 months (Epstein, 1992; Kennedy, 1994; Lane & Gregg, 1992; Reynolds, 1992; Scott, 1992, p. 28). She has been incorrectly called the first female serial killer; Wuornos was, however, one of the few such women who hunted her murder victims in a predatory fashion (Fox & Levin, 1994, pp. 22-24; Scott, p. 63). A roadside prostitute of no fixed address, she hitchhiked from the Florida interstate entrances and truck stops in an effort to find customers. From November 1989 to November 1990 some of these men became her victims. They were shot and robbed, then their bodies and vehicles dumped in various locations over a vast area that stretched from the Atlantic Ocean to the Gulf of Mexico.

After her arrest Wuornos argued self-defence, claiming that each of her seven victims had tried to rape her. She asserted her innocence emphasizing that
Figure 41. Crime Site Point Pattern - Aileen Wuornos.
Figure 42. Isopleth Map – Aileen Wuornos (All Sites).
she was not a serial killer, only someone who had killed a series of men. Considered a compulsive liar, Wuornos was diagnosed as possessing both borderline and antisocial personality disorders. After a rather histrionic trial the jury found Aileen Wuornos guilty of murder and unanimously sentenced her to death in the electric chair.

This case violates the selection criterion that the serial killer not be nomadic. The graph of the crime site point pattern for Aileen Wuornos is presented in Figure 41. The exact locations of the victim encounter and murder sites are not known in this case. While Wuornos was nomadic and lived in different motels in various cities, she did appear to have an anchor point located in Wildwood, Florida. It was from the I-75 truck stop here that she would hitchhike and pick up many of her clients. The isopleth map (all sites) for this case is presented in Figure 42, and the choropleth map in Figure 43.

*Ian Brady and Myra Hindley*

The Moors Murderers, Ian Brady and Myra Hindley, hunted their victims in the Manchester area of England from 1963 to 1965 (Harrison, 1987; Williams, 1967). Brady converted Hindley to his neo-Nazi world view and involved her in a
life of sexual sadism, pornography, and petty crime. The two lovers eventually turned to murder, killing five people, all children or teenagers. Brady and Hindley buried the bodies of their victims on Saddleworth Moor thereby earning the pair their infamous nickname.

Police found the corpse of the last victim in a back bedroom of the house where Brady and Hindley lived together after receiving a tip from Hindley’s brother-in-law. He had witnessed the attack the night before. Extensive digging on the moors uncovered three of the victims’ remains, though the body of remaining victim has never been found. Brady was found guilty of three murders and Hindley of two. The killers escaped death twice, once when police discovered a plan by one of the victim’s uncles to shoot them during the trial, and again when *The Murder (Abolition of Death Penalty) Act 1965* was passed a month after their arrest.

This case violates the selection criterion that there be at least 5 different locations of the same type associated with a single offender residence. The graph of the crime site point pattern for Ian Brady and Myra Hindley is presented in Figure 44. They moved to an outlying estate (the easternmost residence marked on the graph) during the murder series, and for their last two crimes commuted into Manchester to search for victims. The bodies of their victims were buried on the
Figure 44. Crime Site Point Pattern – Ian Brady and Myra Hindley.
moors about an hour's drive east of the city. The isopleth map (victim encounter sites) for this case is presented in Figure 45, and the choropleth map in Figure 46.

*Jerry Brudos*

Jerry Brudos, the Lust Killer, murdered at least four women in western Oregon from 1968 to 1969 (Lane & Gregg, 1992; Newton, 1990a; Rule, 1983a, Time-Life Books, 1992b). After strangling them he would mutilate their bodies in the garage beside his house before dumping their corpses, weighed down with automotive parts, in the local rivers. Though he was married and had children, he forbade his family from entering the locked garage.

Brudos had a shoe fetish and was attracted to some of his victims because of their footwear. He would often break into homes and steal shoes or lingerie, and possessed a collection of 40 pairs of high-heeled shoes. Brudos liked to dress up and photograph the corpses of his victims. He amputated the foot of his first victim and stored it, shod, in the freezer.

Arrested after a tip from a suspicious college student whom he had dated, Brudos eventually confessed to police investigators. A search of his home revealed, amongst other bizarre souvenirs of the crimes, disturbing photographs of
Figure 47. Crime Site Point Pattern – Jerry Brudos.
his captive victims. Brudos pled guilty and was sentenced to three consecutive life sentences. Incarcerated in the Oregon State Penitentiary, he will be eligible for parole in 1999.

This case violates the selection criterion that there be a minimum of 5 murder victims. The graph of the crime site point pattern for Jerry Brudos is presented in Figure 47. After the first murder, Brudos moved from Portland to Salem (the southernmost residence marked on the graph). One of his dump sites was used twice. The isopleth map (all sites) for this case is presented in Figure 48, and the choropleth map in Figure 49.

Serial Murder Characteristics

Serial Killers

A breakdown of the characteristics for the 15 serial killers in the microlevel data set is given in Table 8. Percentages and frequencies, or means, are used as appropriate. This is a summary of the information collected in the PhD Data Coding Form #1: Serial Killers (see Appendix B for the data coding form, and Appendix C for coding rules). Additionally, co-killer information is presented indicating whether a serial murderer operated alone, or with a partner.
Of the various serial murderer classifications discussed in the literature, only the FBI organized/disorganized dichotomy and the Holmes and De Burger typology were examined in the present research. The former was included since degree of organization can influence offender activity space (see above), and the latter, because it is one of the more commonly accepted typologies (see, for example, Barrett, 1990, pp. 149-165; Egger, 1990, p. 27; Fox & Levin, 1995a; Hickey, 1991, pp. 14-15; Holmes, 1989, pp. 55-59; Holmes & De Burger, 1988, pp. 55-60; Holmes & Holmes, 1994, pp. 109-111, 119-126; Robbins, 1991, pp. 10-52; Rossmo, 1995c).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>87% (13)</td>
</tr>
<tr>
<td>Female</td>
<td>13% (2)</td>
</tr>
<tr>
<td>Co-Killer</td>
<td></td>
</tr>
<tr>
<td>Operated Alone</td>
<td>73% (11)</td>
</tr>
<tr>
<td>Operated With Partner</td>
<td>27% (4)</td>
</tr>
<tr>
<td>Mean Total Number of Victims</td>
<td>12</td>
</tr>
<tr>
<td>Mean Total Number of Locations</td>
<td>23</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Results</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Mean Duration of Murder Activity</td>
<td>2.7 Years</td>
</tr>
<tr>
<td>Degree of Organization</td>
<td></td>
</tr>
<tr>
<td>Organized</td>
<td>47% (7)</td>
</tr>
<tr>
<td>Somewhat Organized</td>
<td>20% (3)</td>
</tr>
<tr>
<td>Mixed</td>
<td>20% (3)</td>
</tr>
<tr>
<td>Somewhat Disorganized</td>
<td>7% (1)</td>
</tr>
<tr>
<td>Disorganized</td>
<td>7% (1)</td>
</tr>
<tr>
<td>Typology</td>
<td></td>
</tr>
<tr>
<td>Visionary</td>
<td>20% (3)</td>
</tr>
<tr>
<td>Mission-Oriented</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Lust</td>
<td>13% (2)</td>
</tr>
<tr>
<td>Thrill</td>
<td>13% (2)</td>
</tr>
<tr>
<td>Comfort</td>
<td>7% (1)</td>
</tr>
<tr>
<td>Power/Control-Oriented</td>
<td>47% (7)</td>
</tr>
<tr>
<td>Residence Type</td>
<td></td>
</tr>
<tr>
<td>Detached House</td>
<td>53% (8)</td>
</tr>
<tr>
<td>Semi-Detached House</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Apartment</td>
<td>33% (5)</td>
</tr>
<tr>
<td>Hotel or Motel</td>
<td>7% (1)</td>
</tr>
</tbody>
</table>
Table 8. Serial Killer Data.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rooming or Lodging House</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Trailer</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Institution</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Transient</td>
<td>7% (1)</td>
</tr>
<tr>
<td>Homeless</td>
<td>0% (0)</td>
</tr>
</tbody>
</table>

The mean total number of victims, mean total number of locations, and mean duration of murder activity estimates are all based on case, not offender, averages. The serial murder cases involved a lone offender 85% of the time. There was an average of 1.9 crime locations per victim in this sample. The figures in Table 8 suggest that there are no significant differences between the microlevel and macrolevel data sets with regards to these specific variables (see Table 5).

Most of the offenders seemed to fit the power/control-oriented serial murder typology. The mean degree of organization was 2.1 (somewhat organized),
assuming that the coding scale was interval level. Serial killers usually lived in a detached house or an apartment building.

**Victims**

A breakdown of the characteristics for the 178 serial murder victims in the microlevel data set is given in Table 9. Percentages and frequencies, or means, are used as appropriate (percentages may add to more than 100 because of multiple responses). This is a summary of the information collected in the *PhD Data Coding Form #2: Serial Murder Victims* (see Appendix B for the data coding form, and Appendix C for coding rules). Additionally, information is presented indicating crime type (murder, attempted murder, rape, or other sexual assault, coded as the most serious offence), and secondary victim status (yes – same incident, yes – same day, or no). The latter field is used to distinguish cases of multiple victims, either murdered in the same incident, or else on the same day. The crime location set data is presented and discussed in the following chapter.
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crime Type</strong></td>
<td></td>
</tr>
<tr>
<td>Murder</td>
<td>75.3% (134)</td>
</tr>
<tr>
<td>Attempted Murder</td>
<td>16.9% (30)</td>
</tr>
<tr>
<td>Rape</td>
<td>5.1% (9)</td>
</tr>
<tr>
<td>Other Sexual Assault</td>
<td>2.8% (5)</td>
</tr>
<tr>
<td><strong>Secondary Victim</strong></td>
<td></td>
</tr>
<tr>
<td>Yes – Same Incident</td>
<td>12.9% (23)</td>
</tr>
<tr>
<td>Yes – Same Day</td>
<td>4.5% (8)</td>
</tr>
<tr>
<td>No</td>
<td>82.6% (147)</td>
</tr>
<tr>
<td><strong>Sex of Victim</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>27.5% (49)</td>
</tr>
<tr>
<td>Female</td>
<td>72.5% (129)</td>
</tr>
<tr>
<td><strong>Victim/Killer Relationship</strong></td>
<td></td>
</tr>
<tr>
<td>Stranger</td>
<td>93.8% (167)</td>
</tr>
<tr>
<td>Casual Acquaintance</td>
<td>6.2% (11)</td>
</tr>
<tr>
<td>Known</td>
<td>0% (0)</td>
</tr>
<tr>
<td><strong>Killer Selection</strong></td>
<td></td>
</tr>
<tr>
<td>Nonrandom/Patterned</td>
<td>74.7% (133)</td>
</tr>
<tr>
<td>Random/Nonpatterned</td>
<td>25.3% (45)</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Results</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td><strong>Victim Traits</strong></td>
<td></td>
</tr>
<tr>
<td>Specific</td>
<td>47.8% (85)</td>
</tr>
<tr>
<td>Nonspecific</td>
<td>52.2% (93)</td>
</tr>
<tr>
<td><strong>Victim Activity</strong></td>
<td></td>
</tr>
<tr>
<td>At Home</td>
<td>30.9% (55)</td>
</tr>
<tr>
<td>At Work</td>
<td>1.1% (2)</td>
</tr>
<tr>
<td>Commuting</td>
<td>6.2% (11)</td>
</tr>
<tr>
<td>Walking or Jogging</td>
<td>21.9% (39)</td>
</tr>
<tr>
<td>Hitchhiking</td>
<td>5.1% (9)</td>
</tr>
<tr>
<td>Other Travel</td>
<td>12.4% (22)</td>
</tr>
<tr>
<td>Visiting Friend</td>
<td>2.2% (4)</td>
</tr>
<tr>
<td>Outdoor Recreation</td>
<td>0% (0)</td>
</tr>
<tr>
<td>At Bar or Nightclub</td>
<td>10.7% (19)</td>
</tr>
<tr>
<td>At Other Social Event</td>
<td>5.1% (9)</td>
</tr>
<tr>
<td>Prostitution</td>
<td>22.5% (40)</td>
</tr>
<tr>
<td>Other</td>
<td>8.4% (15)</td>
</tr>
<tr>
<td><strong>Killer Hunting Style – Search Method</strong></td>
<td></td>
</tr>
<tr>
<td>Hunter</td>
<td>31.6% (49)</td>
</tr>
<tr>
<td>Poacher</td>
<td>54.8% (85)</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Results</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Troller</td>
<td>11.6% (18)</td>
</tr>
<tr>
<td>Trapper</td>
<td>1.9% (3)</td>
</tr>
</tbody>
</table>

**Killer Hunting Style – Attack Method**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raptor</td>
<td>78.7% (122)</td>
</tr>
<tr>
<td>Stalker</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Ambusher</td>
<td>21.3% (33)</td>
</tr>
</tbody>
</table>

**Control Method**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firearm</td>
<td>6.7% (12)</td>
</tr>
<tr>
<td>Knife</td>
<td>3.4% (6)</td>
</tr>
<tr>
<td>Blunt Instrument</td>
<td>2.8% (5)</td>
</tr>
<tr>
<td>Strangulation</td>
<td>0.6% (1)</td>
</tr>
<tr>
<td>Physical Force</td>
<td>18.5% (33)</td>
</tr>
<tr>
<td>Intoxicant</td>
<td>16.9% (30)</td>
</tr>
<tr>
<td>Threat</td>
<td>6.2% (11)</td>
</tr>
<tr>
<td>Blitz Attack (Victim Immediately Killed)</td>
<td>51.1% (91)</td>
</tr>
<tr>
<td>Unknown</td>
<td>6.7% (12)</td>
</tr>
</tbody>
</table>

**Murder Method**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firearm</td>
<td>25.8% (46)</td>
</tr>
<tr>
<td>Knife</td>
<td>16.9% (30)</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Results</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Blunt Instrument</td>
<td>21.3% (38)</td>
</tr>
<tr>
<td>Strangulation</td>
<td>37.6% (67)</td>
</tr>
<tr>
<td>Physical Force</td>
<td>2.2% (4)</td>
</tr>
<tr>
<td>Poison</td>
<td>0.6% (1)</td>
</tr>
<tr>
<td>Other</td>
<td>0.6% (1)</td>
</tr>
<tr>
<td>Unknown</td>
<td>3.9% (7)</td>
</tr>
<tr>
<td>No Murder Attempt</td>
<td>9% (16)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attempt to Hide Body</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Displayed</td>
<td>7.3% (13)</td>
</tr>
<tr>
<td>Dumped</td>
<td>10.7% (19)</td>
</tr>
<tr>
<td>Other Not Hidden</td>
<td>34.3% (61)</td>
</tr>
<tr>
<td>Casually Hidden</td>
<td>10.1% (18)</td>
</tr>
<tr>
<td>Well Hidden</td>
<td>25.3% (45)</td>
</tr>
<tr>
<td>Other</td>
<td>12.4% (22)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Linked</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Linked</td>
<td>72.3% (112)</td>
</tr>
<tr>
<td>Unlinked</td>
<td>27.8% (43)</td>
</tr>
</tbody>
</table>

Table 9. Serial Murder Victim Data.
Percentages for killer hunting style – search method, killer hunting style – attack method, killer approach, and victim linkage were based on the 155 cases that did not involve same-incident secondary victims. Most of the cases classified as “other” for attempt to hide body involved the escape of the victim. Almost three-quarters of the victims in this sample were linked to the murder series. Cases not connected usually involved the failure to recognize the existence of a serial killer rather than the inability to match a specific victim with a known series.

Cleary and Rettig (1994, p. 7) suggest that the stranger victims of serial killers are not randomly selected, but instead fit into a particular agenda known to the murderer. Similarly, Warren et al. (1995) observe that “serial rapists do not manifest random patterns when geographically choreographing their offenses” (p. 247). Three-quarters of the victim selections in this study were classified as nonrandom or patterned, and almost one-half of the victims possessed specific traits of interest to the offender. It would appear that the “randomness” ascribed to serial murder refers more to its stranger nature (94% in the sample) than to any mathematical description of sampling process (i.e., method of victim selection).

Most of the victims in the present study were sought out by the offender either through poaching or hunting search behaviour. The former characteristic was originally thought to make a case unsuitable for offender residence prediction.
It seems, however, that while serial killers often commute, they usually do so in various directions. After enough crimes there is a substantial likelihood that the offender’s residence will be found within his or her hunting area. The Boston Strangler was the only murderer whose poaching hunting behaviour proved to be a concern for the CGT analysis (see below). The data in this study supports the suggestion of Davies and Dale (1995b, p. 16) that marauding (hunting) and commuting (poaching) are only ends of a continuum.

The raptor approach was the most common attack method. Ambushes were primarily associated with either hunting or poaching search behaviour. There were no instances of victims being stalked (as defined in the present hunting typology) prior to attack,73 despite the assertions of Norris (1988, pp. 25-28) and Holmes (1991, p. 67) that serial and lust killers often engage in elaborate stalking as part of their careful, pre-crime, planning. Keeney and Heide (1994c) found little evidence of stalking behaviour on the part of the female serial murderers in their study; over one-third of them, however, aggressively procured or lured their victims.

73 This may be the result of the present study’s selection methodology. Stalking behaviour has been observed in cases of serial rape, and analysis of overlaps in victims’ routine activities, in an effort to identify common ground that could be connected to the offender, has proven to be a useful line of police inquiry (J. L. LeBeau, personal communication, July 7, 1995).
Multiple responses were allowed for victim activity, and 225 actions were recorded. Disturbingly, almost one-third of the victims in this sample were attacked in their own homes.\textsuperscript{74} Other common activities included walking or jogging, and prostitution. Not quite three-quarters of the victims were females. Multiple responses were also allowed for control method and murder method, and 201 and 210 responses respectively were recorded. Over one-half of the victims were controlled by an immediate and deadly blitz attack. Strangulation was the preferred method of murder. Only one-quarter of the victims' bodies were well hidden by the killer.

\textit{Crime Locations}

A breakdown of the characteristics for the 347 crime locations in the microlevel data set is given in Table 10. Percentages and frequencies, or means, are used as appropriate (percentages may add to more than 100 because of multiple responses). This is a summary of the information collected in the PhD

\textsuperscript{74} By comparison, 64\% of the serial rape encounter sites in the FBI study were at the victim's home or workplace, and 70\% were indoors (Warren, Reboussin, & Hazelwood, 1995, pp. 61-62, 85-87). Only 15\% of these crimes involved transportation. Offenders who primarily raped indoors tended to be more selective in their victim choice.
Data Coding Form #3: Serial Murder Locations (see Appendix B for the data coding form, and Appendix C for coding rules). Additionally, information calculated from the crime location data is presented regarding offence day of week (Monday to Sunday), and distance from offender residence to crime site (measured on a Manhattan metric, and expressed in kilometres).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crime Location Type</td>
<td></td>
</tr>
<tr>
<td>Encounter Site</td>
<td>27.7% (96)</td>
</tr>
<tr>
<td>Encounter/Attack Site</td>
<td>2.3% (8)</td>
</tr>
<tr>
<td>Encounter/Attack/Murder Site</td>
<td>1.4% (5)</td>
</tr>
<tr>
<td>Encounter/Attack/Murder/Body Dump Site</td>
<td>19.9% (69)</td>
</tr>
<tr>
<td>Attack Site</td>
<td>1.7% (6)</td>
</tr>
<tr>
<td>Attack/Murder Site</td>
<td>11.0% (38)</td>
</tr>
<tr>
<td>Attack/Murder/Body Dump Site</td>
<td>15.0% (52)</td>
</tr>
<tr>
<td>Murder Site</td>
<td>2.6% (9)</td>
</tr>
<tr>
<td>Murder/Body Dump Site</td>
<td>1.4% (5)</td>
</tr>
<tr>
<td>Body Dump Site</td>
<td>13.5% (47)</td>
</tr>
<tr>
<td>Body Dump/Vehicle Drop Site</td>
<td>0.9% (3)</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Results</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Vehicle Drop Site</td>
<td>2.3% (8)</td>
</tr>
<tr>
<td>Found Evidence Site</td>
<td>0.3% (1)</td>
</tr>
<tr>
<td>Day of Week</td>
<td>Encounter Sites</td>
</tr>
<tr>
<td>Monday</td>
<td>12.9% (20)</td>
</tr>
<tr>
<td>Tuesday</td>
<td>10.3% (16)</td>
</tr>
<tr>
<td>Wednesday</td>
<td>8.4% (13)</td>
</tr>
<tr>
<td>Thursday</td>
<td>16.8% (26)</td>
</tr>
<tr>
<td>Friday</td>
<td>7.7% (12)</td>
</tr>
<tr>
<td>Saturday</td>
<td>16.1% (25)</td>
</tr>
<tr>
<td>Sunday</td>
<td>23.2% (36)</td>
</tr>
<tr>
<td>Unknown</td>
<td>4.5% (7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distance to Crime Site</th>
<th>Encounter</th>
<th>Body Dump</th>
<th>All Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Crimes Sites</td>
<td>155</td>
<td>104</td>
<td>320</td>
</tr>
<tr>
<td>Mean Distance</td>
<td>21.8 km</td>
<td>33.7 km</td>
<td>25.8 km</td>
</tr>
<tr>
<td>0 Kilometres</td>
<td>1.3% (2)</td>
<td>16.3% (17)</td>
<td>11.9% (38)</td>
</tr>
<tr>
<td>0.1 – 1.0 Kilometres</td>
<td>7.1% (11)</td>
<td>1.0% (1)</td>
<td>4.4% (14)</td>
</tr>
<tr>
<td>1.1 – 5.0 Kilometres</td>
<td>14.8% (23)</td>
<td>2.9% (3)</td>
<td>8.8% (28)</td>
</tr>
<tr>
<td>5.1 – 10.0 Kilometres</td>
<td>11.6% (18)</td>
<td>13.5% (14)</td>
<td>10.3% (33)</td>
</tr>
<tr>
<td>10.1 – 15.0 Kilometres</td>
<td>15.5% (24)</td>
<td>5.8% (6)</td>
<td>9.4% (30)</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.1 – 20.0 Kilometres</td>
<td>4.5% (7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.8% (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.4% (14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.1 – 50.0 Kilometres</td>
<td>34.2% (53)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>29.8% (31)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>29.1% (93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 50 Kilometres</td>
<td>5.2% (8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20.2% (21)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.6% (34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>5.8% (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.8% (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11.3% (36)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crime Location Known to Police</td>
<td>Encounter</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Body Dump</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All Sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>70.3% (109)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>67.3% (70)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>60.9% (195)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>29.7% (46)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>32.7% (34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>39.1% (125)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area Land Use</td>
<td>Encounter</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Body Dump</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All Sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td>45.8% (71)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>45.2% (47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>45% (144)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>43.2% (67)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.8% (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24.4% (78)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>0% (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.8% (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.4% (11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Institutional</td>
<td>3.2% (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.0% (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.9% (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Park</td>
<td>1.3% (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.8% (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.5% (8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural or Agricultural</td>
<td>0.6% (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12.5% (13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.3% (17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilderness or Uninhabited</td>
<td>1.3% (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21.2% (22)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.1% (29)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>4.5% (7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.8% (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.4% (27)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site Description</td>
<td>Encounter</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Body Dump</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All Sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residence</td>
<td>29% (45)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>17.3% (18)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>27.2% (87)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hotel or Motel</td>
<td>0.6% (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0% (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.3% (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristic</td>
<td>Results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>--------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Building</td>
<td>1.3% (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School or Educational</td>
<td>0.6% (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business or Shopping Site</td>
<td>11% (17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entertainment Site</td>
<td>5.8% (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red-Light Zone</td>
<td>23.2% (36)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle</td>
<td>6.5% (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Transportation</td>
<td>10.3% (16)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Yard</td>
<td>1.3% (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parking Lot</td>
<td>3.9% (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Street or Sidewalk</td>
<td>51% (79)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alley, Lane, Pathway, or Trail</td>
<td>0.6% (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway or Ditch</td>
<td>5.8% (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Park</td>
<td>1.9% (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm, Field, or Open Area</td>
<td>0% (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>River, Lake, or Marsh</td>
<td>0% (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest or Woods</td>
<td>0.6% (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hills or Mountains</td>
<td>0% (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desert or Wasteland</td>
<td>0% (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0% (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11% (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.8% (6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.3% (17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.8% (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.7% (7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.8% (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.9% (3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.7% (7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.8% (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.7% (7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristic</td>
<td>Results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unknown</strong></td>
<td>0% (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Site Classification</strong></td>
<td>Encounter Body Dump All Sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inside Private</strong></td>
<td>27.7% (43)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inside Semi-Public</strong></td>
<td>7.1% (11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inside Public</strong></td>
<td>2.6% (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Outside Private</strong></td>
<td>1.3% (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Outside Semi-Public</strong></td>
<td>0% (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Outside Public</strong></td>
<td>61.3% (95)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unknown</strong></td>
<td>0% (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Killer Travel Method</strong></td>
<td>Encounter Body Dump All Sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vehicle</strong></td>
<td>81.9% (127)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Public Transportation</strong></td>
<td>8.4% (13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>On Foot</strong></td>
<td>7.7% (12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>1.3% (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unknown</strong></td>
<td>0.6% (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Victim or Killer Residence</strong></td>
<td>Encounter Body Dump All Sites</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Killer Residence</strong></td>
<td>1.3% (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Victim Residence</strong></td>
<td>25.2% (39)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Both</strong></td>
<td>0% (0)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

325
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neither</td>
<td>73.5% (114)</td>
</tr>
<tr>
<td></td>
<td>81.7% (85)</td>
</tr>
<tr>
<td></td>
<td>74.1% (237)</td>
</tr>
<tr>
<td>Unknown</td>
<td>0% (0)</td>
</tr>
<tr>
<td></td>
<td>0% (0)</td>
</tr>
<tr>
<td></td>
<td>1.3% (4)</td>
</tr>
</tbody>
</table>

Table 10. Serial Murder Location Data.

The crime location type counts are based on all 347 crime locations. The rest of the Table 10 is based on 320 crime locations, excluding those sites connected to same-incident secondary victims. Day of week was based only on the encounter site dates. The other characteristics are presented for victim encounter sites, body dump sites, and all sites. For this purpose the following crime locations types were classified as victim encounter sites (a total of 155 locations): (1) encounter; (2) encounter/attack; (3) encounter/attack/murder; and (4) encounter/attack/murder/body dump. The following crime locations types were classified as body dump sites (a total of 104 locations): (1) attack/murder/body dump; (2) murder/body dump; (3) body dump; and (4) body dump/vehicle drop. There were no sites coded as “location victim last seen,” or as “witness site,” and it appears that these were not useful categories.
Figure 50 shows serial murder incidents by day of week (based on encounter site date). Almost 40% of the cases occurred on the weekend as evidenced by the Saturday/Sunday bulge in the radar chart. Consistent with the routine activities approach, such a finding can be explained by the greater opportunity an offender has to engage in search activities, or the increased availability of suitable victims in the preferred hunting grounds, during the weekend.\textsuperscript{75} Total time at scene estimates are not presented as the data was considered unreliable.

The mean distance to crime site figures excluded an outlier from the Night Stalker case which involved a murder Ramirez had committed in San Francisco (645 km from his home). The valid percentages of cases falling into various distance to crime site ranges are shown in Figure 51. Excepting those cases where the offender kept the victim’s remains at home, body dump sites tended to be located further from the killer’s residence than victim encounter sites. This is probably the result of two factors. First, it appears that victim search activity occurs frequently while body disposal happens infrequently (for example, see the

\textsuperscript{75} Warren, Reboussin, and Hazelwood (1995, pp. 63, 210-214) found no difference in serial rape occurrence by day of week, but did observe larger hunting areas associated to weekend offenders. Such a result is consistent with the greater victim search opportunities available to employed offenders on Saturdays and Sundays.
Figure 51. Distance to Crime Site.
case synopsis of Clifford Olson, above). Second, optimal body disposal sites are often situated in uninhabited regions, some distance from urban areas.

While only 61% of all sites were known to police, this figure increased to 67% for body dump sites and 70% for encounter sites. These two location types are the most important in geographic profiling and it is usually sufficient to know one or the other for the purposes of a CGT analysis (see Table 20 below). Approximately 12% of the crime sites were within the killer’s residence. Such locations are likely to be unknown to the police.

Multiple responses were allowed for site description, and 238 encounter site types, 144 body dump site types, and 476 total site types were recorded. Streets and residences were the most common crime locations. The “other” classification usually referred to deserted lots or waste ground. Residential and commercial land use predominated. The majority of incidents occurred in outside public places, followed by inside private places. Serial murderers preferred to travel by vehicle.
Criminal Geographic Targeting Results

Tables 11 to 19 present the results of the CGT analysis, providing data on crime site patterns, hunting area size, point pattern statistics, nearest neighbour distances, hit percentages, and search areas (the implications of these results are discussed below). Figures are given separately for victim encounter, victim encounter/body dump (i.e., there was no victim transport), and body dump sites as applicable. A minimum of five different locations of the same crime site type connected to a single residence were necessary for that site type to be individually analyzed. Table 20 shows the comparative CGT hit percentages for those cases where more than one type of crime site was available for examination.

Where multiple crime sites occurred at the same place the location was only counted once (determining if two sites were situated close enough to be at the “same place” or not could be a problematic judgment call in nonurban areas).\(^76\) It should be noted that the number of locations that appear on the crime site point pattern graphs may vary from the figures given in the following tables (e.g., Figure

\(^{76}\) In all instances where subjective choices had to be made the decisions were approached from the perspective of an ongoing investigation. The experience gained through the preparation of actual geographic profiles helped ground the analysis in the real world.
This is the result of the scale of the map hiding multiple locations. In other words, two or more separate crime sites may be close enough together to appear as a single dot on the crime site point pattern graph.

<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Number of Crime Sites</th>
<th>Hunting Area</th>
<th>Area/Crime Site</th>
<th>Offence Circle Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olson</td>
<td>15</td>
<td>299 km²</td>
<td>19.96 km²</td>
<td>311 km²</td>
</tr>
<tr>
<td>Buono and Bianchi</td>
<td>9</td>
<td>487 km²</td>
<td>54.09 km²</td>
<td>519 km²</td>
</tr>
<tr>
<td>Collins</td>
<td>7</td>
<td>62.56 km²</td>
<td>8.94 km²</td>
<td>100 km²</td>
</tr>
<tr>
<td>Dahmer</td>
<td>10</td>
<td>6.80 km²</td>
<td>0.68 km²</td>
<td>9.16 km²</td>
</tr>
<tr>
<td>Brady and Hindley</td>
<td>5</td>
<td>57.38 km²</td>
<td>11.48 km²</td>
<td>82.28 km²</td>
</tr>
<tr>
<td>Brudos</td>
<td>6</td>
<td>5,726 km²</td>
<td>954 km²</td>
<td>10,167 km²</td>
</tr>
<tr>
<td>Mean</td>
<td>8.7</td>
<td>1,106 km²</td>
<td>175 km²</td>
<td>1,865 km²</td>
</tr>
</tbody>
</table>

Table 11. Crime Site Patterns (Victim Encounter Sites).
<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Nearest Neighbour Distance</th>
<th>Average Interpoint Distance</th>
<th>Furthest Neighbour Distance</th>
<th>Standard Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olson</td>
<td>3.03 km</td>
<td>10.03 km</td>
<td>19.90 km</td>
<td>6.69 km</td>
</tr>
<tr>
<td>Buono and Bianchi</td>
<td>3.99 km</td>
<td>13.18 km</td>
<td>25.70 km</td>
<td>8.25 km</td>
</tr>
<tr>
<td>Collins</td>
<td>1.21 km</td>
<td>7.54 km</td>
<td>11.30 km</td>
<td>4.82 km</td>
</tr>
<tr>
<td>Dahmer</td>
<td>0.13 km</td>
<td>2.17 km</td>
<td>3.42 km</td>
<td>1.36 km</td>
</tr>
<tr>
<td>Brady and Hindley</td>
<td>4.23 km</td>
<td>6.35 km</td>
<td>10.24 km</td>
<td>3.64 km</td>
</tr>
<tr>
<td>Brudos</td>
<td>9.85 km</td>
<td>74.19 km</td>
<td>114 km</td>
<td>44.87 km</td>
</tr>
<tr>
<td>Mean</td>
<td>3.74 km</td>
<td>18.91 km</td>
<td>30.76 km</td>
<td>11.61 km</td>
</tr>
</tbody>
</table>

Table 12. Point Pattern Analysis (Victim Encounter Sites).

<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Centroid Distance</th>
<th>R Scale(^{77})</th>
<th>CGT Hit Percentage</th>
<th>Search Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olson</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Res 1</td>
<td>4.14 km</td>
<td>1.07</td>
<td>15.81%</td>
<td>47.33 km(^2)</td>
</tr>
<tr>
<td>Res 2</td>
<td>7.76 km</td>
<td></td>
<td>3.03%</td>
<td>9.06 km(^2)</td>
</tr>
<tr>
<td>Buono</td>
<td>7.39 km</td>
<td>0.849</td>
<td>9.36%</td>
<td>45.55 km(^2)</td>
</tr>
<tr>
<td>Bianchi</td>
<td>2.69 km</td>
<td></td>
<td>3.19%</td>
<td>15.55 km(^2)</td>
</tr>
</tbody>
</table>

\(^{77}\) R scale values with a single asterisk are significant at the \(p < 0.05\) level, and those with a double asterisk at the \(p < 0.01\) level.
<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Centroid Distance</th>
<th>R Scale</th>
<th>CGT Hit Percentage</th>
<th>Search Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collins</td>
<td>5.12 km</td>
<td>0.689</td>
<td><strong>1.06%</strong></td>
<td>0.66 km²</td>
</tr>
<tr>
<td>Dahmer</td>
<td>2.06 km</td>
<td>0.320 **</td>
<td><strong>8.65%</strong></td>
<td>0.59 km²</td>
</tr>
<tr>
<td>Brady and Hindley</td>
<td>1.38 km</td>
<td>1.86 **</td>
<td>29.39%</td>
<td>16.86 km²</td>
</tr>
<tr>
<td>Brudos</td>
<td>Res 1 56.54 km</td>
<td>0.611</td>
<td>0.21%</td>
<td>12.24 km²</td>
</tr>
<tr>
<td></td>
<td>Res 2 38.55 km</td>
<td></td>
<td><strong>2.24%</strong></td>
<td>128 km²</td>
</tr>
<tr>
<td>Mean</td>
<td>13.96 km</td>
<td>0.90</td>
<td><strong>8.10%</strong></td>
<td>30.65 km²</td>
</tr>
</tbody>
</table>

Table 13. CGT Results (Victim Encounter Sites).

<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Number of Crime Sites</th>
<th>Hunting Area</th>
<th>Area/Crime Site</th>
<th>Offence Circle Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chase</td>
<td>5</td>
<td>7.99 km²</td>
<td>1.60 km²</td>
<td>4.37 km²</td>
</tr>
<tr>
<td>DeSalvo</td>
<td>14</td>
<td>1,256 km²</td>
<td>89.73 km²</td>
<td>1,596 km²</td>
</tr>
<tr>
<td>Ramirez</td>
<td>21</td>
<td>6,393 km²</td>
<td>304 km²</td>
<td>9,180 km²</td>
</tr>
<tr>
<td>Berkowitz</td>
<td>10</td>
<td>816 km²</td>
<td>81.65 km²</td>
<td>775 km²</td>
</tr>
<tr>
<td>Mean</td>
<td>12.5</td>
<td>2,118 km²</td>
<td>119 km²</td>
<td>2,889 km²</td>
</tr>
</tbody>
</table>

Table 14. Crime Site Patterns (Victim Encounter/Body Dump Sites).
<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Nearest Neighbour Distance</th>
<th>Average Interpoint Distance</th>
<th>Furthest Neighbour Distance</th>
<th>Standard Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chase</td>
<td>1.35 km</td>
<td>2.00 km</td>
<td>2.36 km</td>
<td>1.07 km</td>
</tr>
<tr>
<td>DeSalvo</td>
<td>2.82 km</td>
<td>21.46 km</td>
<td>45.08 km</td>
<td>15.55 km</td>
</tr>
<tr>
<td>Ramirez</td>
<td>7.89 km</td>
<td>30.79 km</td>
<td>108 km</td>
<td>21.65 km</td>
</tr>
<tr>
<td>Berkowitz</td>
<td>4.61 km</td>
<td>16.54 km</td>
<td>31.41 km</td>
<td>10.18 km</td>
</tr>
<tr>
<td>Mean</td>
<td>4.17 km</td>
<td>17.7 km</td>
<td>46.71 km</td>
<td>12.11 km</td>
</tr>
</tbody>
</table>

Table 15. Point Pattern Analysis (Victim Encounter/Body Dump Sites).

<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Centroid Distance</th>
<th>R Scale</th>
<th>CGT Hit Percentage</th>
<th>Search Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chase</td>
<td>0.30 km</td>
<td>1.59*</td>
<td>1.67%</td>
<td>0.13 km²</td>
</tr>
<tr>
<td>DeSalvo</td>
<td>1.82 km</td>
<td>0.463**</td>
<td>17.76%</td>
<td>223 km²</td>
</tr>
<tr>
<td>Ramirez</td>
<td>16.56 km</td>
<td>0.731*</td>
<td>9.78%</td>
<td>625 km²</td>
</tr>
<tr>
<td>Berkowitz</td>
<td>10.72 km</td>
<td>0.751</td>
<td>4.68%</td>
<td>38.20 km²</td>
</tr>
<tr>
<td>Mean</td>
<td>7.35 km</td>
<td>0.884</td>
<td>8.47%</td>
<td>222 km²</td>
</tr>
</tbody>
</table>

Table 16. CGT Results (Victim Encounter/Body Dump Sites).
<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Number of Crime Sites</th>
<th>Hunting Area</th>
<th>Area/Crime Site</th>
<th>Offence Circle Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olson</td>
<td>11</td>
<td>14,262 km²</td>
<td>1,297 km²</td>
<td>14,137 km²</td>
</tr>
<tr>
<td>Buono and Bianchi</td>
<td>9</td>
<td>305 km²</td>
<td>33.94 km²</td>
<td>324 km²</td>
</tr>
<tr>
<td>Sutcliffe</td>
<td>20</td>
<td>9,547 km²</td>
<td>477 km²</td>
<td>12,476 km²</td>
</tr>
<tr>
<td>Rifkin</td>
<td>16</td>
<td>25,278 km²</td>
<td>1,580 km²</td>
<td>25,934 km²</td>
</tr>
<tr>
<td>Collins</td>
<td>7</td>
<td>368 km²</td>
<td>52.54 km²</td>
<td>421 km²</td>
</tr>
<tr>
<td>Wuornos (Body)</td>
<td>6</td>
<td>16,980 km²</td>
<td>2,830 km²</td>
<td>14,054 km²</td>
</tr>
<tr>
<td>Wuornos (Vehicle)</td>
<td>7</td>
<td>14,970 km²</td>
<td>2,139 km²</td>
<td>17,113 km²</td>
</tr>
<tr>
<td>Mean</td>
<td>10.86</td>
<td>11,673 km²</td>
<td>1,201 km²</td>
<td>12,066 km²</td>
</tr>
</tbody>
</table>

Table 17. Crime Site Patterns (Body Dump Sites).

<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Nearest Neighbour Distance</th>
<th>Average Interpoint Distance</th>
<th>Furthest Neighbour Distance</th>
<th>Standard Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olson</td>
<td>16.48 km</td>
<td>75.99 km</td>
<td>134 km</td>
<td>51.35 km</td>
</tr>
<tr>
<td>Buono and Bianchi</td>
<td>4.85 km</td>
<td>12.30 km</td>
<td>20.31 km</td>
<td>7.62 km</td>
</tr>
<tr>
<td>Sutcliffe</td>
<td>4.79 km</td>
<td>51.13 km</td>
<td>126 km</td>
<td>35.84 km</td>
</tr>
</tbody>
</table>

336
<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Nearest Neighbour Distance</th>
<th>Average Interpoint Distance</th>
<th>Furthest Neighbour Distance</th>
<th>Standard Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rifkin</td>
<td>18.99 km</td>
<td>78.05 km</td>
<td>182 km</td>
<td>51.95 km</td>
</tr>
<tr>
<td>Collins</td>
<td>5.26 km</td>
<td>11.26 km</td>
<td>23.17 km</td>
<td>6.72 km</td>
</tr>
<tr>
<td>Wuornos (Body)</td>
<td>47.04 km</td>
<td>92.29 km</td>
<td>134 km</td>
<td>49.72 km</td>
</tr>
<tr>
<td>Wuornos (Vehicle)</td>
<td>37.44 km</td>
<td>83.84 km</td>
<td>148 km</td>
<td>47.67 km</td>
</tr>
<tr>
<td>Mean</td>
<td>19.26 km</td>
<td>57.84 km</td>
<td>110 km</td>
<td>35.84 km</td>
</tr>
</tbody>
</table>

Table 18. Point Pattern Analysis (Body Dump Sites).

<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Centroid Distance</th>
<th>R Scale</th>
<th>CGT Hit Percentage</th>
<th>Search Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olson</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Res 1</td>
<td>50.16 km</td>
<td>0.801</td>
<td>8.01%</td>
<td>1,142 km²</td>
</tr>
<tr>
<td>Res 2</td>
<td>44.46 km</td>
<td></td>
<td></td>
<td>1,779 km²</td>
</tr>
<tr>
<td>Buono</td>
<td>1.34 km</td>
<td>1.23</td>
<td>9.17%</td>
<td>28.01 km²</td>
</tr>
<tr>
<td>Bianchi</td>
<td>11.42 km</td>
<td></td>
<td>40.33%</td>
<td>123 km²</td>
</tr>
<tr>
<td>Sutcliffe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Res 1</td>
<td>12.97 km</td>
<td>0.337**</td>
<td>4.87%</td>
<td>465 km²</td>
</tr>
<tr>
<td>Res 2</td>
<td>17.48 km</td>
<td></td>
<td>2.43%</td>
<td>232 km²</td>
</tr>
<tr>
<td>Rifkin</td>
<td>29.28 km</td>
<td>0.757</td>
<td>7.24%</td>
<td>1,829 km²</td>
</tr>
</tbody>
</table>
Table 19. CGT Results (Body Dump Sites).

<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Centroid Distance</th>
<th>R Scale</th>
<th>CGT Hit Percentage</th>
<th>Search Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collins</td>
<td>8.27 km</td>
<td>1.12</td>
<td>23.82%</td>
<td>87.60 km²</td>
</tr>
<tr>
<td>Wuornos (Body)</td>
<td>23.52 km</td>
<td>1.37</td>
<td>3.79%</td>
<td>643 km²</td>
</tr>
<tr>
<td>Wuornos (Vehicle)</td>
<td>30.24 km</td>
<td>1.41*</td>
<td>5.43%</td>
<td>813 km²</td>
</tr>
<tr>
<td>Mean</td>
<td>22.91 km</td>
<td>1.00</td>
<td>11.76%</td>
<td>714 km²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>CGT Hit Percentage (Encounter Sites)</th>
<th>CGT Hit Percentage (Body Dump Sites)</th>
<th>CGT Hit Percentage (All Sites)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chase</td>
<td></td>
<td>1.67%</td>
<td>1.10%</td>
</tr>
<tr>
<td>Olson</td>
<td>15.81%</td>
<td>8.01%</td>
<td>1.01%</td>
</tr>
<tr>
<td></td>
<td>3.03%</td>
<td>12.47%</td>
<td>1.31%</td>
</tr>
<tr>
<td>Buono</td>
<td>9.36%</td>
<td>9.17%</td>
<td>6.31%</td>
</tr>
<tr>
<td>Bianchi</td>
<td>3.19%</td>
<td>40.33%</td>
<td>7.56%</td>
</tr>
<tr>
<td>Collins</td>
<td>1.06%</td>
<td>23.82%</td>
<td>1.23%</td>
</tr>
<tr>
<td>Wuornos</td>
<td>5.43%</td>
<td>3.79%</td>
<td>10.75%</td>
</tr>
</tbody>
</table>

338
In the Clifford Olson case, the hit percentage as calculated from the body dump sites for Agassiz Mountain Prison was 2.47% (search area = 352 square kilometres). And in the John Collins case, the hit percentage as calculated from the body dump sites for Eastern Michigan University was 15.03% (search area = 55.28 square kilometres). Both the Olson and Collins case details suggest the possibility that these locations may have been significant offender anchor points. The implications of this are discussed in the conclusion.

78 The combined locations for the Chase case include body dump and vehicle drop sites. The combined locations for the Collins case include encounter, murder, and body dump sites. The combined locations for the Wuornos case include body dump and vehicle drop sites.
While the primary purpose in this study for determining extent of offender hunting area was the calculation of search area size, there may be other value in such a measure. The FBI used the concept of a convex hull polygon (CHP) to help analyze the point patterns formed by serial rapists (Warren et al., 1995, pp. 49-50, 205-218). The CHP is the area enclosed by a convex polygon that connects the outer locations of a crime series, containing by definition all the offender’s crime sites. For local serial rapists (travel under 20 miles) the mean CHP area was 7.14 square miles. Warren et al. found that the average CHP size was larger for commuters than for marauders (11.38 vs. 7.62 square miles), for rapists who burgled (15.24 vs. 2.49 square miles), and for those offenders who lived outside of the CHP area enclosing their crimes (23.53 vs. 3.22 square miles). They suggest that if replicated, this last finding may be useful in determining where a serial rapist resides.79

79 Other crime scene aspects can also help identify components of offender spatial behaviour. For example, nighttime offending by serial rapists was found to be a model characteristic for 90% of the marauders, compared to 70% of the commuters (Warren, Reboussin, & Hazelwood, 1995, pp. 157, 160, 169). This was perhaps due to the greater concern of the former over the need to protect their identities when hunting locally. Commuters also demonstrated more ritualized behaviour than did marauders.
Model Optimization

Model Parameters

The parameters of the probability function in Equation 18 determine the behaviour of the CGT model and their proper specification can optimize its predictive ability. The model parameters used in the present research were developed from exploratory analysis conducted with cases of serial rape and serial arson (see, for example, Alston, 1994; Canter, 1994; Canter & Larkin, 1993; LeBeau, 1991, 1992). To avoid the problem of equivalency between testing and learning data sets, the microlevel data were not used to optimize the performance of the CGT model.

The value of the distance exponent \( f = 1.2 \) was selected from a gravity model formulation developed to describe interprovincial migration patterns of criminal fugitives (Rossmo, 1987, p. 136). This same exponent was used for distances both within and outside the buffer zone radius \( g = f \).

As the probability function only produces relative, as opposed to absolute scores, the main purpose served by the constant \( k \) is the prevention of program variable overflow (variable values must remain within the precision range of the specified integer and floating-point numeric variable types used in the CGT model).
software). To best accomplish this task the value of the constant was allowed to change, its specification varying with the other parameters and the total size of the hunting area.

The radius of the buffer zone \((B)\) was initially set at 0.3 miles (approximately 0.5 kilometres). While this was a reasonable estimate for certain cases, it became apparent that the value was inappropriate for those offenders who operated over large metropolitan or regional areas. In such cases the buffer zone effectively “disappeared.” It was therefore necessary to define a variable radius, one flexible enough to accommodate different ranges of criminal mobility. An approach to such a definition was suggested by the crime site point pattern itself; it appeared that an indication of buffer zone size could be provided by the distances between points.

Consequently, the radius was set to equal the mean of the nearest neighbour distance (calculated using a Manhattan metric). This value was later modified slightly to address the spatial behaviour of certain offenders who commit crimes

---

\(^{80}\) Warren, Reboussin, and Hazelwood (1995, pp. 205-215) found minimum crime trip distances (i.e., smaller “non-offending areas”) were shorter for marauders than for commuters (0.74 vs. 2.51 miles), nonwhites than whites (1.23 vs. 2.70 miles), younger than older offenders (0.59 vs. 2.58 miles), and nighttime than daytime rapists (1.44 vs. 3.12 miles). Not surprisingly, minimum and mean crime trip distances were correlated.
both close to and far from their homes. The final buffer zone radius was established at one-half the mean nearest neighbour distance.

The performance of the CGT model might be further improved through a systematic optimization analysis. In particular, the manner in which the buffered distance-decay function is specified appears to be important. Analysis on certain serial rape cases suggests that the buffer zone could be better described as an annulus, rather than a radius, a depiction that would in effect “smooth out” the transition between the two distance states (see Figure 2). One method of accomplishing such an effect is through the use of a third or fourth-order polynomial function.

Validity

For geographic profiling to distinguish itself from geomancy it must meet certain standards. Any scientific or police investigative methodology should fulfill three important criteria – validity, reliability, and utility (see Oldfield, 1995). Specification of the methodology’s limitations is also critical (Poythress et al., 1993, pp. 9-10), and this is the function of the serial murderer hunting typology. For the CGT analysis to work, the offender’s residence must lie somewhere within
the hunting area. Therefore most commuting killers (poachers) should be excluded from this form of analysis.

The CGT model works on the assumption that a relationship, modeled on some form of distance-decay function, exists between crime location and offender residence. The process can be thought of as a mathematical method for assigning a series of scores to the various points on a map that represents the killer's hunting area. For the CGT model to be valid, the score it assigns to the point containing the offender's residence (referred to as the "hit score") should be relatively high; that is, there should be few points on the hunting area map with equal or higher scores. This can be shown as a distribution curve indicating the number of points with various scores (see Figure 52, derived from the CGT analysis of the victim encounter sites of Clifford Olson). A uniform distribution would assign the same score to every point, producing a smooth, flat line. (If $N$ is the total number of points on the map, then the probability associated with each point would be $1/N$.)

The "success" of the CGT model in a given case can be measured by determining the ratio of the total number of points with scores equal or higher to the hit score, to the total number of points in the hunting area. This is equivalent to the percentage of the total area that would have to be searched before the offender's residence was found, assuming an optimal search process (i.e., one that
started in the locations with the highest scores and then worked down). The smaller that percentage (referred to as the "hit percentage"), the more successful the model. The extent of the search area (the territory that the police would have to search in order to find the offender) is therefore equal to the size of the hunting area multiplied by the hit percentage.

With a uniform score distribution hit percentages would average 50%. Using any system based on a uniform distribution, the police could expect to locate the offender, on average, in one-half of the hunting area. Investigating suspects alphabetically, tips chronologically, or canvassing from the northwest to the southeast are all examples of such systems.

Monte Carlo testing, accomplished through a computer program that generates random crime site coordinates based on a fixed-buffered distance-decay function,\(^{81}\) was conducted to estimate the theoretical maximum efficiency of the model. The testing produced the "learning curve" shown in Figure 53, which displays the relationship between the number of crime sites available for analysis and the mean hit percentage produced by the CGT model. The curve for the

\(^{81}\) This function produces a pattern similar to Rengert's (1990, 1991) bull's-eye distribution. The CGT model is slightly less efficient when tested on other hypothesized forms of crime site geography (teardrop, bimodal, and uniform spatial patterns).
Figure 53. CGT Model Learning Curve.
associated standard deviations are also shown. These figures should be considered as the optimal, rather than the expected, performance levels of the model.

This process established that at least 6 crime locations are necessary to produce hit percentages under 10%. The power functions that best fit this learning curve ($R^2 = 0.973$) and the associated standard deviations curve ($R^2 = 0.942$) are given in Equations 21 and 22, respectively:

\[ H\% = 56 T^{-1.16} \]  \hspace{1cm} (21)

\[ SD = 45 T^{-1.02} \]  \hspace{1cm} (22)

where:

\[ H\% \] is the mean hit percentage;

\[ T \] is the total number of crime sites; and

\[ SD \] is the hit percentage standard deviation.
Figure 54 shows a comparison between the distribution of CGT hit percentages found in the present study and that expected by chance. The validity of the CGT model can be tested by plotting, in a Lorenz curve (see Figure 55), groupings of hit percentages against those from a uniform distribution (i.e., what would be expected strictly by chance), and then applying an index of dissimilarity or concentration. One such measure is the Gini coefficient (Goodall, 1987, pp. 195, 280; Taylor, 1977, pp. 179-185). For the present application it would be equal to:

\[ G = \frac{1}{N} \sum_{i=1}^{N} |x_i - y_i|/2 \] (23)

where:

- \( G \) is the Gini coefficient;
- \( N \) is the total number of observations;
- \( x_i \) is the \( i \)th member of the uniform percentage frequency; and
- \( y_i \) is the \( i \)th member of the hit percentage frequency.
Figure 54. Comparative Hit Percentage Distributions.
The Gini coefficient ranges from 0 to 100, with 0 indicating exact correspondence between the two sets of percentage frequencies, and 100 indicating complete lack of correspondence. In the present case, the closer the Gini coefficient is to 100, the more successful or valid the CGT model.

Tables 13, 16, 19, and 20 list different CGT hit percentages, varying by crime site type and offender residence, for a given case. For the purposes of determining the performance of the model, the following selections were made:

1. Cases were excluded if there were not five separate locations, of the same type, connected to a single anchor point (this only eliminated the Brady and Hindley case).

2. When multiple site types were available for analysis, preference was first given to victim encounter sites, and then to body dump sites (see below for a discussion on optimal choice of crime site type).

3. If a serial killer lived in more than one residence during the murder series, the address at which he or she resided for the majority of the murders was used (the one exception was the Berkowitz case as his second residence was located outside the hunting area and could not be analyzed).
4. When two offenders were involved, the dominant offender’s residence was used (this only affected the Buono and Bianchi case).

The 12 specific CGT hit percentages used in calculating the index of dissimilarity are marked in bold in Tables 13, 16, and 19. Using 5% intervals, the Gini coefficient for the study sample is equal to 85, indicating a high level of validity.

An alternative measure of performance can be obtained by doubling the mean hit percentage. The lower this value the greater the predictive power of the model. A value of 0 indicates optimal performance, while a value of 1 would be expected strictly by chance. As the mean hit percentage of the above cases was 5.97%, this measure is equal to approximately 0.12. All else being equal, this suggests that an area search conducted through a geoprofile would find, on average, the offender’s residence in 12% of the time that a random search would take. The relative performance of the CGT model is thus 837% (1/0.1195).

82 With an average of 11.58 crime locations, the actual mean hit percentage (5.97%) was higher than that predicted from the Monte Carlo testing (3.80%). This degradation is most likely attributable to departures from uniformity in target backcloths.
Reliability

The reliability of the CGT process is high as the calculations are mathematically straightforward and the procedure is computerized. The determination of exactly which crime locations in a given case are relevant to the analysis (see above), however, is a subjective decision dependent upon the knowledge, experience, and interpretations of the person performing the analysis (see Benfer et al., 1991, pp. 7-9). The following guidelines, informed by the present research, should be considered when deciding which crime sites are most likely to be the best predictors of offender residence location:

- Preference should be given to the crime site type that affords the greatest degree of choice to the serial killer. Site types with constrained target backcloths may indicate little about the offender. If victim specificity leads to a spatial bias then encounter locations may not be the best choice of site type. Similarly, an urban-based serial killer who disposes of victims in isolated areas may reveal little through his or her selection of dumping ground.

- Preference should be given to those crime site types that have the greatest number of unique locations. This should theoretically decrease
the expected CGT hit percentage. Multiple offences in the same place should not be counted more than once.

- Combining different site types to increase the total number of locations available for analysis may be advantageous when the number of crimes is low. Two problems exist, however, with this approach. The first is that the locations may be significantly correlated. This is particularly likely when the offender goes directly to the dump site from the encounter site. For example, the Yorkshire Ripper picked up prostitutes, parked a short distance away to conduct business, and then killed and dumped their bodies. While not identical, the encounter and body dump sites in this series are close to being equivalent. The Hillside Stranglers, by contrast, originated their victim disposal trips from Buono's home where the murders took place. The second problem occurs when the combined crime sites produces a hunting area larger than that found with any of the site types singly. Even though the hit percentage may be smaller, the actual search area could be significantly larger. This problem is most likely to occur if the two crime site areas are not congruent. Clifford Olson, for example, appeared to use different mental maps for his victim searches and body dumps. Aileen Wuornos left both body dump and
vehicle drop sites, the former likely suggestive of where she was coming from, and the latter of where she was going to.

- Preference should be given to those crime site types where the locations are accurately known. The position of a dump site may be more precise than that of the encounter as the latter sometimes has to be inferred from where the victim was last seen. In some investigations, the locations of one or both site types may not be known at all.

Utility

No matter how valid or reliable a particular investigative technique, it will have little practical value if it cannot effectively be used in the real world of murder investigation. It is important to realize that even a very accurate CGT prediction (i.e., a small hit percentage) will not lead police investigators to the offender's doorstep. Certain psychics have allegedly been successful in finding criminal offenders, missing people, and buried bodies (Lyons & Truzzi, 1991,

83 A British medium claims to have accurately predicted the Yorkshire Ripper's name and street address 18 months prior to the arrest of Peter Sutcliffe (Lyons & Truzzi, 1991, p. 93; see also Nicholson, 1979, chap. 9). Her assertion cannot be substantiated.
chap. 5, pp. 262-263). Geographic profiling cannot do this. The process is only an information management system, and to that end it must be useful to and compatible with the overall police investigation.

The scope of the search area for a given CGT hit percentage depends on the size of the hunting area. With a small hunting area the geoprofile will suggest the most likely streets or blocks where the offender may reside; with a large hunting area it will indicate the most likely cities or towns. It is important to remember that the resolution of an analysis is bounded by its information input.

Table 21 lists average population and household estimates for five urban area types in Vancouver, British Columbia (1991 Canada Census data; _Vancouver local areas 1981-1991_, 1994). Figures are given for metropolitan district, core city, and high, medium, and low density residential neighbourhoods (estimates are high in that many areas contain uninhabited regions such as industrial sectors, parks, water, farmland, or wilderness). While these numbers vary by city and region, it can be seen that even a search area as small as one square kilometre can contain hundreds of people. This suggests that there may be limited investigative value in a map which only delineates the most probable area of offender residence.
<table>
<thead>
<tr>
<th>Urban Residential Area</th>
<th>Total Population</th>
<th>Private Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metropolitan District</td>
<td>580/km²</td>
<td>220/km²</td>
</tr>
<tr>
<td>Core City</td>
<td>4,190/km²</td>
<td>1,770/km²</td>
</tr>
<tr>
<td>High Density Neighbourhood</td>
<td>19,800/km²</td>
<td>13,530/km²</td>
</tr>
<tr>
<td>Medium Density Neighbourhood</td>
<td>6,290/km²</td>
<td>3,430/km²</td>
</tr>
<tr>
<td>Low Density Neighbourhood</td>
<td>2,380/km²</td>
<td>790/km²</td>
</tr>
</tbody>
</table>


The utility of the CGT model is best demonstrated by the various geographically-based investigative strategies that such a process makes possible. Some examples of such applications include suspect prioritization by address, directed patrol saturation tactics, and the retrieval of computerized database information on the basis of location, licence plate registration, telephone number, or postal/zip code. These and other examples will be discussed more thoroughly in the next chapter.
CHAPTER VI
DISCUSSION

Certain implications for the geography of crime arising from the research will be examined in this chapter. Some of these findings, including the notion of crime location sets, the clustering of crime sites, and the increase in crime trip distance over time, have relevance for the linkage and investigation of serial crime. The process now used in preparing a geographic profile for an unsolved case, and the attendant investigative strategies, are also discussed.

Implications for the Geography of Crime

Crime Location Sets

Most of the geography of crime literature treats the concept of crime site as a single location, but depending on the type of crime there may be various locations connected to a single offence.84 Each of these has a potentially different meaning to the offender and, consequently, distinctive choice properties. For

84 Exceptions include the works of Amir (1971) and LeBeau (1987c).
serial murder such location types include victim encounter, attack, murder, and body dump sites. While these particular actions could all occur at one place, in the majority of the cases studied they were divided up between two or more different locations.

Eight possible combinations, referred to as crime location sets, can result from these four different crime site types. The specific location set for a given crime is a function of victim selection and encounter site characteristics, but it also implies something about the offender, how he or she searches for victims, and the associated level of organization and mobility. Generally, the greater the organization and mobility of the offender, the greater the potential complexity (i.e., the more separate locations) of the crime location set.

Table 22 presents the crime location set breakdown by serial murderer. Movements between victim encounter (E), attack (A), murder (M), and body dump (D) sites are represented by an arrow (→). For example, EAM→D indicates that the encounter, attack, and murder sites were in the same place, but the body dump site was at a different location.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chase</td>
<td>1</td>
<td>6</td>
<td>14</td>
<td>15</td>
<td>12</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>DeSalvo</td>
<td>3</td>
<td>12</td>
<td>3</td>
<td>15</td>
<td>12</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Olson</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>15</td>
<td>12</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Buono &amp; Bianchi</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>20</td>
<td>33</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Wuornos</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>20</td>
<td>32</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Sutcliffe</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Ramirez</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Berkowitz</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Dahmer</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Brady &amp; Hindley</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Brudos</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Rifkin</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Serial Murderer</td>
<td>E→A→M→D</td>
<td>E→A→MD</td>
<td>E→AM→D</td>
<td>EA→M→D</td>
<td>EA→MD</td>
<td>E→AMD</td>
<td>EAM→D</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Collins</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Column Total</td>
<td>3</td>
<td>3</td>
<td>38</td>
<td>6</td>
<td>2</td>
<td>52</td>
<td>5</td>
</tr>
<tr>
<td>Percentage</td>
<td>1.7%</td>
<td>1.7%</td>
<td>21.3%</td>
<td>3.4%</td>
<td>1.1%</td>
<td>29.2%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Number of Sites</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>47</td>
<td>59</td>
<td>69</td>
<td>178</td>
<td>178</td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>1.7%</td>
<td>26.4%</td>
<td>33.1%</td>
<td>38.8%</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 22. Crime Location Sets.
There was a high level of geographic consistency in the modus operandi of the present sample as most offenders repeatedly employed the same crime location set. Approximately 85% of the total number of serial murder victims \((N = 178)\) fell into the most common crime location set used by their killer, and 96% into either the first or second most common crime location sets. This implies that crime location set might be used as an assessment characteristic for the linking of serial offences.\(^{85}\)

An understanding of consistency, change, and progression in offender behaviour is an important principle of linkage analysis. Warren et al. (1995, pp. 243, 254-255) found that about one-half of the 119 quantified behaviours they examined from serial rape crime scenes remained consistent over time. Other offender behaviours either showed progression (e.g., degree of planning, protection of identity, and use of bindings), or exhibited inconsistent change. They suggest it may be that the more pathological aspects stay constant while the less unusual ones change. “The idea of consistency and change represents an important area of serial crime: in theory, it helps to define relevant dimensions of

---

\(^{85}\)ViCLAS, the RCMP computerized linkage analysis system, was designed with certain geographic profiling requirements in mind. It is possible to conduct queries, amongst other search criteria, based on crime location set similarities.
classificatory paradigms, which can inform investigative efforts to link crimes perpetrated by the same offender” (p. 255). An awareness of consistency and change in offender geographic behaviour can enhance this effort (see, for example, Dettlinger & Prugh, 1983, pp. 125-126).

Crime Site Clusters

Short-term spatial selectivity has been observed in the hunting behaviour of animals and certain predators often repeatedly visit the same forage sites (Smith, 1974a, 1974b; Smith & Sweatman, 1974). Such geotropism is also found with serial killers, many of whom return to favoured sites to hunt victims or dispose of their remains in cluster dumps or forest “graveyards” (Newton, 1992, p. 81). The Yorkshire Ripper and the Son of Sam, for example, were both known to revisit the areas of their previous crimes in pursuit of new victims (Canter, 1994, p. 140; Ressler & Shachtman, 1992, pp. 68-69).

“When we went to New York to talk to the ‘Son of Sam,’ David Berkowitz,” says Robert K. Ressler, the agent in charge of the project, “he told us that on the nights when he couldn’t find a victim to kill he would go back to the scene of an old crime to relive the crime and to fantasize about
it. Now that's a heck of a piece of information to store somewhere to see whether other offenders do the same thing.” (Porter, 1983, pp. 49-50)

The $R$ scale values from the CGT analysis (see Tables 13, 16, and 19) show a variety of pattern spacing in the serial murder crime sites. Of the 17 point patterns analyzed, 8 were clustered (4 significantly), 5 were dispersed (3 significantly), and 4 were random (none significantly). There appears to be a tendency towards aggregation in the patterns (10 of the 17 $R$ scale values were smaller than 1). Clustering may be even more common than suggested by this study as locations with multiple crime sites were only counted once. Also, the victim encounter sites of Sutcliffe and Rifkin, and the body dump sites of Dahmer and Brady and Hindley were not separately analysed (all four of these patterns are significantly clustered). The main influence on divergence from randomness appears to be target backcloth; not surprisingly, a lack of uniformity leads to clustering.

LeBeau (1985) notes “the proclivity of chronic serial offenders to use repeatedly the same geographic and ecological space.... The geographical and ecological patterning of the serial offender may be tangible information which is

---

86 A pattern was defined as clustered if $R < 0.800$, dispersed if $R > 1.20$, and random otherwise.
discerned by police investigators and utilized in apprehension" (p. 397). Using a nearest neighbour analysis, he found the mean distance between crime scenes for chronic serial rapists in San Diego to vary from 0.12 to 0.85 miles, averaging 0.35 miles (1986, pp. 29-30). And Büchler and Leineweber (1991, p. 201), observing that bank robbers in Germany tended to follow similar patterns of escape, suggest that such information can help police connect these crimes.

Davies and Dale (1995b, pp. 14-15) found several cases of geographic "backtracking" in their study of British rapists. They propose that national access to intelligence information on former crime sites, and people and places of significance to an offender, would be an important investigative resource (pp. 14-15). Serial killer Monte Rissell was apprehended only after he returned to his former rape sites in Alexandria, Virginia (Ressler & Shachtman, 1992, p. 117).

**Crime Trip Distance Increase**

It has been suggested that individual offender journey to crime distances most likely increase over time (see above), but there has been little empirical testing of this hypothesis. In an attempt to see what influence, if any, time had on the crime trip distances travelled by the present sample of serial murderers, their
cases were examined both individually and collectively. It should be remembered that any particular journey to crime may not have originated from the offender’s residence, that a given killer may have been responsible for unknown murders not included in the present study, and that most of the serial killings were preceded by a number of other crimes including burglary, robbery, and sexual assault. Also, some of the offenders moved residence in the midst of their murder series, complicating journey to crime comparisons.

The Manhattan distance from offender residence to location of victim encounter was measured for every crime in each killer’s series (the case of Aileen Wuornos was excluded as the locations of her victims’ encounter sites are not known). Where two or more victims were attacked during the same day, only the first crime was counted. The offences were chronologically ordered, outliers excluded, and gaps ignored (only five victims were omitted – one with an unknown encounter site, two involving offences committed in cities being visited by the offender, and two occurring after the offender had moved to a new state). Distance from offender residence to encounter site was plotted against crime number. These graphs, showing crime trip distances up to 20 kilometres, up to 50 kilometres, and up to 150 kilometres, are shown, respectively, in Figures 56, 57, and 58.
Figure 57. Crime Trip Distance Over Time (50 Km Range).
Figure 58. Crime Trip Distance Over Time (150 Km Range).
Table 23 summarizes these results. Of the 12 serial murder cases analyzed, 6 showed a significant increase (defined as a slope with an $R^2 > 0.300$), 6 exhibited no significant change, and none showed a significant decrease in crime trip distance. As average journey to crime distance varied considerably by offender (ranging from 1 to 40 kilometres), the slopes were compared to each individual serial murderer's mean crime trip distance. This figure, shown in the proportion column of Table 23, represents the incremental increase in crime trip distance expressed as a proportion of the mean crime trip distance. The overall mean percentage increase is 16% (standard deviation = 17).

<table>
<thead>
<tr>
<th>Serial Murderer</th>
<th>Slope</th>
<th>$R^2$</th>
<th>Crime Trip Distance (km)</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Minimum</td>
<td>Mean</td>
</tr>
<tr>
<td>Chase</td>
<td>0.50</td>
<td>0.878</td>
<td>0.61</td>
<td>1.19</td>
</tr>
<tr>
<td>DeSalvo</td>
<td>1.21</td>
<td>0.173</td>
<td>7.28</td>
<td>16.42</td>
</tr>
<tr>
<td>Olson</td>
<td>0.37</td>
<td>0.051</td>
<td>0.52</td>
<td>7.13</td>
</tr>
<tr>
<td>Buono</td>
<td>-0.66</td>
<td>0.033</td>
<td>0</td>
<td>10.83</td>
</tr>
<tr>
<td>Sutcliffe</td>
<td>0.08</td>
<td>0.000</td>
<td>4.82</td>
<td>35.32</td>
</tr>
<tr>
<td>Ramirez</td>
<td>3.38</td>
<td>0.403</td>
<td>9.20</td>
<td>28.46</td>
</tr>
<tr>
<td>Berkowitz</td>
<td>2.79</td>
<td>0.421</td>
<td>4.82</td>
<td>24.24</td>
</tr>
<tr>
<td>Serial Murderer</td>
<td>Slope</td>
<td>$R^2$</td>
<td>Crime Trip Distance (km)</td>
<td>Proportion</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------</td>
<td>-------</td>
<td>--------------------------</td>
<td>------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Minimum</td>
<td>Mean</td>
</tr>
<tr>
<td>Dahmer</td>
<td>6.31</td>
<td>0.321</td>
<td>0.25</td>
<td>20.07</td>
</tr>
<tr>
<td>Brady</td>
<td>3.73</td>
<td>0.712</td>
<td>0.38</td>
<td>8.30</td>
</tr>
<tr>
<td>Brudos</td>
<td>13.51</td>
<td>0.309</td>
<td>0</td>
<td>40.26</td>
</tr>
<tr>
<td>Rifkin</td>
<td>0.19</td>
<td>0.053</td>
<td>25.62</td>
<td>34.77</td>
</tr>
<tr>
<td>Collins</td>
<td>0.53</td>
<td>0.032</td>
<td>0.20</td>
<td>5.32</td>
</tr>
<tr>
<td>Mean</td>
<td>2.66</td>
<td></td>
<td>4.47</td>
<td>24.44</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>3.97</td>
<td></td>
<td>7.39</td>
<td>13.20</td>
</tr>
</tbody>
</table>

Table 23. Crime Trip Distance Increase.

Figure 59 shows crime trip distance changes in the aggregate. The wide variations in hunting range exhibited by this sample of serial murderers distort the pooled data, therefore the unweighted mean natural logarithm of crime trip distance was plotted against offence number. Only those crime trips with a minimum of five cases were included in the analysis. When a linear trend line is fitted to the data, a significant increase over time is observed ($R^2 = 0.519$).
Figure 59. Mean Logarithm of Crime Trip Distance Over Time.
better fit is found, however, with a third-order polynomial expression \((R^2 = 0.880)\), as shown in Figure 59.

This raises an important issue. The above analysis has assumed that increases over time in crime trip distance are linear. Such an assumption may not be warranted. If journey to crime distance grew proportionately (e.g., if a crime trip was, on average, 10% longer than the previous trip), than the relationship would be best expressed by a power curve. Distances could also increase in steps or after significant thresholds, as suggested by Figure 59. Such a growth process could result from an offender first exploring directional alternatives before increasing crime trip distance. The exact nature of the relationship requires further research, preferably with larger data sets of offenders, responsible for lengthier series of crimes.

The FBI maxim that the first crime in a series is the one closest to the offender's residence was also examined. Of the 12 serial murder cases analyzed, 6 showed a crime trip distance of one mile or shorter (Chase, Olson, Dahmer, Brady, Brudos, and Collins). The first offence was the closest in 5 of the 12 cases, ranking from third to ninth (3rd, 3rd, 4th, 6th, 7th, 7th, and 9th) in the remaining 7 cases. Finally, distance to first offence was calculated as a percentage of the killer's mean crime trip distance. First offence crime trip distance averaged 40%
of the mean (standard deviation = 42) across all cases, and was the shortest trip for those cases with a minimum of 5 locations. The FBI belief in offender residence proximity to first offence appears to be a reasonable though not universal rule, relatively consistent with the notion that crime trip distance increases over time. It was found to apply to about one-half of the cases in the present study.

The argument that journey to crime distance temporally grows is based on the supposition that offenders learn from experience thereby increasing their spatial knowledge. Warren et al. (1995, pp. 214-215, 315-317, 340-341) observed that serial rapists who journeyed greater distances appeared to be those with longer careers, and they found distance indicators to be significantly related to time between successive offences.

An expansion in an offender’s hunting region, however, does not necessarily mean that victims are selected exclusively from the perimeter of the search area; what it does indicate is that increasingly large target areas become available for the offender to hunt within. While this implies crime trip distances will lengthen over time (albeit at a rate slower than the growth of the hunting area), it also suggests there should be an increase in the variation of crime journey distances.
To examine this possibility the crime trip distance standard deviation was calculated in each serial murder case for every crime trip after the first. When the mean standard deviations for all cases were plotted against offence number (see Figure 60), a significant increase was observed over time ($R^2 = 0.790$). This suggests that as a serial murderer's career progresses his or her crime trips may increase in both distance and variation.

Fully one-half of the cases in the present study, however, showed no significant increase in journey to crime distance over time. Indeed, the nearness and least-effort principles, and the tendency for crime locations to cluster (see above), mitigate against expansion. If learning underlies crime trip growth, what need does an offender have to expand his or her spatial knowledge? The most obvious reasons are greater opportunities for victim searching and lowered risk of police detection. Canter (1994, p. 99) suggests that past crime sites become sullied and unattractive to the offender because of the possible risk of increased community vigilance (see Footnote 58, above). And the current research found

87 In times of short food supply, the nomadic Naskapi Indians employed scapulimancy (a technique in which a heat-cracked caribou shoulder is used like a map) to help them find game on the Labrador plateau. Anthropologists have theorized that this divination process produced efficacious results because of its randomizing effect, preventing grassland and tundra areas from being overhunted (Moore, 1957).
Figure 60. Crime Trip Distance Mean Standard Deviation Over Time.
that displacement, occasioned by police intervention or community response, was responsible on several occasions for the shift or expansion of a serial murderer's hunting area (e.g., Bianchi, Sutcliffe, Dahmer, Ramirez, and Berkowitz).

An increase in hunting area size will be most likely when an offender has the capability and need to learn, and will benefit from doing so. Those serial murderers with the capability to learn, in this context, include organized, mobile offenders who possess well developed mental maps. Those with a need to learn include those offenders whose hunting style, body disposal methods, and offence timing allow their crimes to be linked, thereby generating significant community or police response. And those who will benefit from learning include offenders who have been hunting close to home, or who prefer victims who can be found in a variety of areas (i.e., there is a uniform target backcloth).

The case of Joel Rifkin is a good example of such a scenario as he showed little change in his crime trip distances, consistently journeying 37 kilometres to the encounter sites. Rifkin was sane, used an automobile, and was familiar with large areas of New York and Long Island. His victims were street prostitutes and their strangled bodies were dumped, often in steel drums, at remote sites that spanned thousands of square miles. Consequently, the murders were not linked and the police failed to realize that a serial killer was operating in their area.
Rifkin also lived a significant distance from the red-light district in Lower Manhattan where he picked up most of his victims.

**Geographic Profiling**

Clues derived from crime site location and place can be of significant assistance to law enforcement agencies in the investigation of repetitive offences. "Locating where an offender might be is the cornerstone of any detective work ... and provides the foundations from which discovery of the criminal’s identity may proceed" (Canter, 1994, p. 282). The probable spatial behaviour of the offender may be determined from information contained in the crime site locations, their geographic connections, and the characteristics and demography of the surrounding neighbourhoods.

By establishing the probability of the offender residing in various areas, and displaying those results through the use of choropleth or isopleth maps, police efforts to apprehend criminals can be assisted. This information allows police departments to focus their investigative activities, geographically prioritize suspects, and to concentrate saturation or directed patrolling efforts in those zones where the criminal predator is most likely to be active. Such investigative
approaches have been termed geographic profiling (Rossmo, 1995c)\textsuperscript{88} or geoforensic analysis (Newton & Newton, 1985).

Geographic profiling is a strategic information management strategy designed to support serial violent crime investigations. It is a service provided by the Vancouver Police Department to police forces or prosecuting offices upon request (MacKay, 1994, p. 12). The first such profile was prepared in 1990. From 1992 to 1994, geographic profiling was available from the Vancouver Integrated Intelligence Unit (VIIU) (now named the Coordinated Law Enforcement Unit (CLEU) Intelligence). Since 1994, the service has been provided by the Vancouver Police Department, Crime Prevention Unit (CPU). To date, requests have come from a variety of federal, provincial, state, and local law enforcement agencies.

---

\textsuperscript{88} The first academic conference papers using the term geographic profiling were presented in 1992 (Rossmo, 1992a, 1992b), and the first related articles published in 1993 (Rossmo, 1993a, 1993b, 1993c). James L. LeBeau, however, had independently used a similar phrase in a 1986 research proposal submitted to the U.S. National Institute of Justice (NIJ). Entitled \textit{The Geographical Profiling of Serial and Non-Serial Rape Offenders}, the project proposed, amongst other goals, to increase the apprehension probabilities of offenders by reducing the geographic area in which they might be found (LeBeau, 1986, pp. 2-3). The study design relied upon such geostatistical techniques as centrography and nearest neighbour analysis to recognize the patterns produced by specific rapists. Unfortunately, the grant request was not funded.
agencies across North America and Europe, including the RCMP, the FBI, and the U.S. Bureau of Alcohol, Tobacco and Firearms (BATF). The cases have involved crimes of serial murder, serial rape and sexual assault, serial arson, serial robbery, serial exposers, sexual homicide, and kidnapping.

The implementation and growth of geographic profiling within Canadian policing is a direct result of the research conducted for this PhD dissertation, in particular, the development of the CGT program.\(^8^9\) It is therefore an example of criminological research, done in an academic university setting, having practical policy and procedural implications for the criminal justice system.

Geographic profiling focuses on the probable spatial behaviour of the offender within the context of the locations of, and the spatial relationships between, the various crime sites. Since a criminal or psychological profile

\(^8^9\) While the research for this dissertation has only focused on serial killers, the hunting practices of serial rapists and other repetitive violent offenders appear to be similar. This resemblance is not surprising considering many serial murderers started off as serial rapists. In fact, the original CGT program was written to analyze cases of serial arson and serial rape. With certain exceptions, there are theoretical reasons to believe that similitude would exist between the target patterns left by such offenders. Some location types, however, need to be appropriately modified (e.g., victim release sites, as opposed to body dump sites, in the case of serial rape).
provides some insight into the likely motivation, behaviour, and lifestyle of the offender, it is directly connected to his or her spatial activity. Criminal and geographic profiles thus act in tandem to help investigators develop a “picture” of the person responsible for the crimes in question. A geographic profile will be optimized if a criminal profile has first been done. It should be noted that not all types of offenders or categories of crime can be geographically profiled. In appropriate cases, however, such a spatial analysis can produce practical results.

The Profiling Process

A geographic profile fits into a typical criminal investigation in the following sequence:

(1) the occurrence of a crime series;

(2) the employment of traditional investigative techniques;

(3) a linkage analysis determining which crimes are connected;

(4) the preparation of a psychological profile;

(5) the construction of a geographic profile; and
(6) the development of new investigative strategies.

A psychological profile is not a necessary precursor for a geographic profile, though the insights it may provide can be quite useful, particularly in cases involving a minimal number of offences. Geographic profiling has both quantitative (objective) and qualitative (subjective) components. The objective component uses a series of scientific geographic techniques and quantitative measures (such as the CGT program) to analyze and interpret the point pattern created from the locations of the target sites. The validity of such measures, however, is dependent upon the number of locations and thus they may not be appropriate for smaller crime series. The subjective component of geographic profiling is based primarily on a reconstruction and interpretation of the offender’s mental map, and it is here that a psychological profile can be of most help.

Profile Considerations

In addition to the offence locations and times involved in a crime series, some of the other elements that need to be considered in the construction of a geographic profile include:

(1) crime location type;
(2) offender hunting style;

(3) target backcloth;

(4) location of arterial roads and highways;

(5) presence of bus stops and rapid transit stations;

(6) physical and psychological boundaries;

(7) zoning and land use;

(8) neighborhood demographics;

(9) routine activities of the victims; and

(10) any possibilities of displacement.

Appendix D lists the information requirements that must be provided by a police agency when a geographic profile has been requested.

Operational Procedure

The construction of a geographic profile for an unsolved case involves the following operational procedure:
(1) a thorough perusal of the case file, including a review of investigation reports, witness statements, autopsy reports, and the psychological profile (if available);

(2) the detailed examination of crime scene and area photographs;

(3) interviews with lead investigators and crime analysts;

(4) visits, when possible, to each of the crime sites (for a discussion of the importance of this step, see Ressler & Shachtman, 1992, p. 96);

(5) an analysis of demographic data and neighbourhood crime statistics;

(6) the study of street, land use, and transit maps;

(7) a computerized analysis (if appropriate); and

(8) interim and final report writing.

Investigative Strategies

Once a geographic profile has been constructed, a variety of criminal investigative strategies can be employed in a more effective and efficient manner (Canter, 1994, pp. 114, 274). While the specific approaches are best determined
by the police investigators familiar with the case in question, some examples of
tactics used or suggested in the past are presented below. The development of
additional spatially-based applications and innovative investigative techniques is
an interactive process which involves the police officers responsible for the case in
question.

**Suspect Prioritization**

If a lengthy list of suspects has been developed, the geographic profile, in
conjunction with the psychological profile, can help prioritize individuals for
follow-up investigative work. The problem in many serial violent crime
investigations is one of too many suspects rather than one of too few. Profiling
can help prioritize lists of sometimes hundreds if not thousands of suspects, leads,
and tips.

**Patrol Saturation and Static Stakeouts**

Areas in the geoprofile most probably associated with the offender can be used
as the basis for establishing directed or saturation patrolling efforts and static
police stakeouts. This strategy is particularly effective if the crimes appear to be
occurring during certain time periods. Barrett (1990, pp. 96-97, 172) describes how Kentucky police, correctly anticipating the movements of a serial killer though the pattern of his crimes, set up road blocks in a park to question late night motorists. This tactic gathered over 2,000 names for the purpose of cross-comparison with other investigative information.

Through a geographic analysis of the crime sites in the Atlanta Child Murders, Dettlinger came to the conclusion that the killer was commuting along certain city routes (Dettlinger & Prugh, 1983, pp. 125-126). But his suggestion that stakeouts be established at the crucial points in this spatial pattern went unheeded by police, and five more bodies would be dumped near these locations before Task Force officers staking out a Chattahoochee River bridge pulled over Wayne Williams.

Neighbourhood Canvasses

Prioritized areas can also be employed for door-to-door canvassing efforts, grid searches, information sign posting, and community cooperation and media

90 Neighbourhood canvasses and grid searches must sometimes cover vast areas. John Joubert left the body of his first victim, a young newsboy, in high grass beside a gravel road outside of Omaha (Ressler & Shachtman, 1992, p. 96). This was 4 miles from where police located the victim’s bicycle, resulting in an extensive building-to-building
campaigns. Police departments have used this approach to target areas for leaflet distribution, employing prioritized letter carrier walks for strategic household mail delivery. For example, LeBeau (1992, p. 136) notes the case of a serial rapist in San Diego who was arrested through canvassing efforts in an area targeted by analysis of the crime locations. The Vampire Killer, serial murderer Richard Trenton Chase, was caught in the same manner after a psychological profile predicted that he would be living near a recovered vehicle he had stolen from one of the victims (Biondi & Hecox, 1992, pp. 89-92, 100-128; Ressler & Shachtman, 1992, pp. 7-9, 117-118).

**Police Information Systems**

Additional investigative leads may be obtained from the information contained in various computerized police dispatch and record systems. Such systems include, for example, computer aided dispatch (CAD) systems, records management systems (RMS), the RCMP Police Information Retrieval System search. A circle with a radius of 4 miles has an area of 50 square miles (130 square kilometres). A method to geographically prioritize such searches has obvious value.
(PIRS), and the like (Fowler, 1990, pp. 9-10; Rebscher & Rohrer, 1991). Offender profile details and case specifics can help focus the search at this point.

For example, the police may be investigating a series of sexual assaults that have been psychologically profiled as the crimes of an anger retaliatory rapist. Such an offender is "getting even with women for real or imagined wrongs.... the attack is an emotional outburst that is predicated on anger" (Hazelwood, 1987, pp. 178-179). His rapes are often initiated by conflicts with a significant woman in his life and he will frequently select victims who symbolize the source of that conflict. One possible investigative strategy in such a case, then, would involve a search of CAD data for domestic disturbance calls on the dates of the rapes to see which ones originated from the area where the geographic profile suggests that the offender most likely resides.91

Those police agencies that contain computerized records detailing the descriptions, addresses, and modus operandi of local offenders can also use profiling information, including probable area of residence, as the basis for

91 Such a process is particularly powerful with police record systems founded on geographical information systems. The Chicago Police Department, for example, has the capability, with the Illinois Criminal Justice Information Authority's Spatial and Temporal Analysis of Crime (STAC) software, to search for crimes or calls for service by both area and time (Block, 1990, 1993a).
developing search criteria. Many departments have such files for specific types of criminals such as parolees or sex offenders (Brahan, Valcour, & Shevel, 1994; Pilant, 1994; Skogan & Antunes, 1979, pp. 235-236).

Outside Agency Databases

Data banks are often geographically based and information from parole and probation offices, mental health outpatient clinics, social services offices, and other agencies located in prioritized areas can also prove to be of value. For example, LeBeau (1992, p. 133) discusses the case of a serial rapist who emerged as a suspect after the police checked parolee records for sex offenders.

Postal Code Prioritization

The geographic profile can also prioritize postal or zip codes in a city. If suspect offender description or vehicle information exists, prioritized postal codes (representing the most probable 1% or 2% of a city’s area) can be used to conduct effective off-line computer searches of registered vehicle or driver’s licence files contained in provincial or state motor vehicle department records. These parameters act as a form of linear program to produce a surprisingly small set of
records containing fields with all the appropriate data responses. Such a strategy can therefore produce significant results by focusing on limited areas that are of a size manageable for most serious criminal police investigations.

The following is one case example of the use of this approach. The postal codes for a city neighbourhood within which a violent sexual offender was attacking children were prioritized by using the criminal geographic targeting model. First the relevant forward sorting areas (FSA) – the first three digits of the postal code – were identified. The criminal geographic targeting probability map was then superimposed over the letter carrier walks (LC) which were prioritized by probability.

Planning and zoning maps were used to eliminate industrial, commercial, and other nonresidential areas. Socioeconomic and demographic census data were also consulted to reevaluate the priority of those neighbourhoods that were inconsistent with the socioeconomic level of the offender as suggested by the psychological profile. Finally, the local distribution units (LDU) – the last three digits of the postal code – associated with the letter carrier walks were determined.

The complete postal codes, ranked by priority of probability, were then used to conduct an off-line computer search of the provincial motor vehicle department records which contain postal codes as part of the addresses associated with the
vehicle registered owner and driver’s licence files. Suspect vehicle information and an offender description had been developed by the detectives working on the case, and this was combined with the geographic data to effectively focus the offline search.

For example, a new red station wagon driven by a tall white middle-aged male, with dark hair, may seem to be somewhat vague information. The description actually contains several parameters, however: (1) vehicle style; (2) vehicle colour; (3) vehicle year range; (4) driver height range; (5) driver race; (6) driver hair colour; and (7) driver age range. When combined with a prioritized list of postal or zip codes, these parameters can narrow down hundreds of thousands of records to a few dozen vehicles or drivers. This is sufficient discrimination to allow detailed follow-up by police investigators (for an example of a murder investigation involving a computerized vehicle search without such geographic discrimination, see Ressler & Shachtman, 1992, pp. 104-105).

Task Force Computer Systems

Task force operations that have been formed to investigate a specific series of major crimes usually collect and collate their information in some form of
computerized system (see U.S. Department of Justice, 1991b, pp. 16-30). Often these operations suffer from information overload and can benefit by the prioritization of data and by the application of correlation analysis (Keppel & Birnes, 1995, pp. 69-74). Geographic profiling can assist in these tasks through the prioritization of street addresses, postal codes (FSAs, LCs, LDUs), and telephone number (NNXs) areas.

This process can also be linked to information available in CD-ROM telephone directory databases that list residential and business names, telephone numbers, addresses, postal/zip codes, business headings, and standard industrial classification (SIC) codes for most of North America. The details of the specific computer database software used by the task force, including information fields, search time, number of records, and correlational abilities, determine the most appropriate form that the geographic profile should take to maximize its usefulness to the police investigation.

Violent Sex Offender Registries

Violent sex offender registries, such as exist in Washington State (Popkin, 1994; Scheingold, Olson, & Pershing, 1992), are a useful information source for
geographic profiling in cases of serial sex crimes. By providing a list of addresses of known violent sex criminals, such registries can be used with a geographic profile to help prioritize suspects. The U.S. Violent Crime Control and Law Enforcement Act of 1994 “requires states to enact statutes or regulations which require those determined to be sexually violent predators or who are convicted of sexually violent offenses to register with appropriate state law enforcement agencies for ten years after release from prison,” or risk the reduction of Federal grant money (U.S. Department of Justice, 1994a).

**Peak-of-Tension Polygraphy**

In suspicious missing persons cases (presumed homicides), with known suspects, polygraphists have had some success in narrowing down the search area for the victim’s remains through peak-of-tension tests (Hagmaier, 1990; see also Cunliffe & Piazza, 1980, pp. 374-383; Lyman 1993, pp. 206-207; Raskin, 1989). By exposing the suspect to questions concerning the type of location where the victim’s body might have been hidden (e.g., cave, lake, marsh, field, forest, etc.), a deceptive response can help narrow down a search. The process often involves the
use of maps or pictures. The usefulness of a peak-of-tension test can be enhanced when the results are combined with a geographic profile.

Bloodings

During certain sexual murder investigations the British police have conducted large-scale DNA testing of all men from the area of the crime ("How the DNA 'Database,'" 1995). The first such case was the Narborough Murder Enquiry, when "all unalibied male residents in the villages between the ages of seventeen and thirty-four years would be asked to submit blood and saliva samples voluntarily in order to 'eliminate them' as suspects in the footpath murders" (Wambaugh, 1989, pp. 220-221).

Close to 4,000 men from the villages of Narborough, Littlethorpe, and Enderby were tested during the investigation. Considerable police resources and laboratory costs can therefore be involved in such "bloodings." A geographic profile could efficiently direct the testing process through the targeting and prioritization of residents by address or postal code. The use of such a systematic strategy would result in a more effective and less expensive DNA mass screening sampling procedure.
In addition to analyzing the geographic patterns of unsolved crimes for investigative insights, the spatial relationship between the locations of a crime series and a suspect's or accused offender's activity sites can be assessed in terms of the probability of their congruence (Rossmo, 1994a). When combined with other forensic identification findings (e.g., a DNA profile), such information can increase evidential strength and therefore the probability of guilt. Geographic profiling thus has application in both the investigative and criminal trial stages.

---

92 The question of how to most appropriately quantify the weight of forensic identification evidence and rare trait possession is called the generalized island problem (see Balding & Donnelly, 1994, pp. 1-10, 17).
CHAPTER VII
CONCLUSION

“We were just hunting humans. I guess because we thought they were the hardest things to hunt, but humans are the easiest things to hunt.... Sad to say, but it’s true” (convicted Canadian murderer; Boyd, 1988, p. 258).

The ease with which such killers hunt humans has its roots in the basic nature of our society. We simply do not expect to encounter seemingly random violence during the course of our daily lives. Statistically homicide is a rare event, serial murder even more so. Unfortunately, for reasons that no one yet fully understands, the incidence of serial murder in North America seems to be growing. Whatever the cause or nature of that growth the impact of this type of crime is devastating, going far beyond the immediate and secondary victims, reaching to the general community and beyond.

The attempt to expand our knowledge in this area of rare but extreme violence is a challenge to criminology. Even the offenders themselves may not understand why they do what they do. Albert DeSalvo, the Boston Strangler, could not explain his hunting processes to interviewers. “I was just driving –
anywhere – not knowing where I was going. I was coming through back ways, in and out and around. *That's the idea of the whole thing. I just go here and there. I don't know why*” (Frank, 1966, pp. 289-290). But while the actions of serial murderers can be difficult to fathom, an understanding of this type of criminality may provide insights into other, more common acts of aggression. From both community and law enforcement perspectives, any increase in our ability to apprehend such predators is most desirable (see Newark & Sullivan, 1995).

Environmental criminology and routine activity theory provide a general framework for addressing those questions related to spatial behaviour, and the model of crime site selection developed by Brantingham and Brantingham (1981, chap. 1) suggested a specific approach for determining the most probable location of offender residence in cases of serial violent crimes. This PhD dissertation has sought to better understand one small part of the phenomenon of serial murder – the geography of offender hunting patterns.

The dissertation attempted to accomplish three specific goals: (1) to add to the knowledge of serial murder; (2) to examine the geography of serial murder at both macro and microlevels; and (3) to discover a method for determining the most probable area of offender residence from crime site locations. The study was
approached through an analysis of the hunting methods and target patterns of serial killers.

Such research not only expands the currently limited body of research in the area of serial murder but also increases our general knowledge of the geography of crime. Work in this area represents a practical application of criminological theory to the real world of police investigation, not only developing useful information for the law enforcement community but also opening up possibilities for new and innovative investigative methodologies. “Some of our [offender profiling] hypotheses ... seem now to have passed into the general realm of established detective knowledge.... It is this gradual building of elements of certainty by scientific rigour that is the object of the researchers” (Copson, 1993, pp. 20-21).

The CGT model produced valid results with the study sample of serial murder cases, averaging offender residence prediction in 5.97% of the total hunting area. Such performance is significantly above what could be expected by chance. The underlying theory also provides guidelines for consistent and reliable decision making regarding the appropriate use of crime sites in such an analysis. Furthermore, a variety of investigative strategies have been developed to maximize the utility of this process for unsolved cases.
Geographic profiling, a strategic information management system for the investigation of serial violent crime, was developed from the dissertation research. This investigative methodology is designed to help alleviate the problem of information overload that usually accompanies cases of serial murder. By knowing the most probable area of offender residence, police agencies can more effectively utilize their limited resources.

But the cases studied in this dissertation suggest other investigative possibilities beyond those associated with locating offender residence. A geographic profile can be thought of as a fingerprint of the offender’s cognitive map. For example, the geoprofile generated from the locations of Clifford Olson’s dump sites focuses in on Agassiz Mountain Prison where he had once been incarcerated. Inmate records in this case could well have proven to be a productive starting point in the search for viable suspects. Since information on probable personality characteristics developed from a psychological profile would considerably refine this and similar searches, it is important that the two forms of profiling be used in a coordinated fashion.

In the Michigan Murders case, the geoprofile centred on Eastern Michigan University where John Collins was a student and summer employee during his killing spree. In this example, enrollment and employee registries could have been
used to cross-check and prioritize lists of suspects. As important as residence is in structuring activity space, the value of checking business and institutional records should not be overlooked.

But does geographic profiling have any investigative worth when the offender is of no fixed abode? Aileen Wuornos was a highway prostitute who lived a transient lifestyle in various Florida motels. Even so she possessed an anchor point, the delineation of which could have been of value to investigators. Prior to her arrest police suspected the murderer was a female who picked up her victims by hitchhiking, an action typically conducted from freeway entrances. A geoprofile could have located those interstate on-ramps most likely to be used by the offender. The dissemination of such information to state troopers and county sheriffs would have helped the police to more effectively target their suspect field checks.

Much of our information is address based suggesting the possibility of additional innovative strategies. While this dissertation has addressed certain questions, many new ones have been raised that need to be properly examined. The following are only some of the future research objectives:

- It may well be possible to improve the predictive power of the CGT model by further optimization of the probability function parameters.
Comprehensive testing must be undertaken in order to fully exploit the model's potential.

- This study only examined the spatial behaviour of serial killers. While there are reasons to believe the method is applicable to a range of serial violent crime, differences in the hunting methods and target patterns of rapists, arsonists, and bombers should be fully explored. This type of analysis may also be relevant to property offences such as burglary, automobile theft, and bank robbery. These are important research questions that need to be addressed if geographic profiling is to be reliably applied to a full spectrum of predatory criminal behaviour.93

- The CGT analysis uses a Manhattan metric, an assumption that may not be valid for those cases occurring in cities based on concentric rather than grid street layouts. Further research is planned to test the model on serial offenders operating in European urban areas.

93 Warren, Reboissin, and Hazelwood (1995) observed differences between the spatial patterns of serial rapists and serial arsonists, noting that the latter appear to be more likely to reside within the perimeters of their hunting areas. They suggest that "geographical patterns of serial offenses may be crime specific, and that patterns that are characteristic of some types of serial crime may not be characteristic of others" (p. 219).
• To maximize the practical potential of geographic profiling it will be necessary to develop further the software used to conduct the CGT analysis. A GIS-interface that can conduct address-based searches of common police databases (e.g., record management systems, ViCLAS, computer-aided dispatch systems, etc.) should be built. It will also be important to incorporate the results of the dissertation research into an expert system that can guide the analysis.

Of those instances where geographic profiling has been applied to assist in an ongoing investigation, there has yet to be a case where the involved detectives failed to contribute suggestions regarding new applications of the process. Such interaction between academic research and the police field allows an investigative methodology to grow and develop. The importance of geography for criminal investigation and offender profiling strikes a chord within practitioners, a resonance best explained by an old police truism: “When all else fails, return to the scene” (Barrett, 1990, p. 90).
APPENDIX A

SERIAL MURDERER DATA SET
<table>
<thead>
<tr>
<th>Surname</th>
<th>Given Name</th>
<th>Media Name</th>
<th>Co-Killer</th>
<th>Murders</th>
<th>Start</th>
<th>End</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANDERSON</td>
<td>Allen</td>
<td>none</td>
<td></td>
<td>7</td>
<td>1976</td>
<td>1976</td>
<td>CA</td>
</tr>
<tr>
<td>ANGELO</td>
<td>Richard</td>
<td>none</td>
<td></td>
<td>4</td>
<td>1987</td>
<td>1987</td>
<td>NY</td>
</tr>
<tr>
<td>BALL</td>
<td>Joe</td>
<td>none</td>
<td></td>
<td>14</td>
<td>1936</td>
<td>1938</td>
<td>TX</td>
</tr>
<tr>
<td>BANKS</td>
<td>George</td>
<td>none</td>
<td></td>
<td>13</td>
<td>1963</td>
<td>1982</td>
<td>PA</td>
</tr>
<tr>
<td>BANKSTON</td>
<td>Clinton</td>
<td>none</td>
<td></td>
<td>5</td>
<td>1987</td>
<td>1987</td>
<td>GA</td>
</tr>
<tr>
<td>BARBOZA</td>
<td>Daniel</td>
<td>none</td>
<td></td>
<td>59</td>
<td>1963</td>
<td>1986</td>
<td>EC</td>
</tr>
<tr>
<td>BARFLELD</td>
<td>Velma</td>
<td>none</td>
<td></td>
<td>6</td>
<td>1969</td>
<td>1978</td>
<td>NC</td>
</tr>
<tr>
<td>BARNES</td>
<td>James</td>
<td>none</td>
<td></td>
<td>7</td>
<td>1988</td>
<td>1988</td>
<td>MI</td>
</tr>
<tr>
<td>BECK</td>
<td>Martha</td>
<td>Lonely Hearts Killers</td>
<td>1</td>
<td>20</td>
<td>1947</td>
<td>1949</td>
<td>NY</td>
</tr>
<tr>
<td>BELL</td>
<td>Larry</td>
<td>none</td>
<td></td>
<td>6</td>
<td>1975</td>
<td>1985</td>
<td>SC</td>
</tr>
<tr>
<td>BERDELLA</td>
<td>Robert</td>
<td>none</td>
<td></td>
<td>6</td>
<td>1984</td>
<td>1988</td>
<td>MO</td>
</tr>
<tr>
<td>BERKOWITZ</td>
<td>David</td>
<td>Son of Sam</td>
<td></td>
<td>6</td>
<td>1976</td>
<td>1977</td>
<td>NY</td>
</tr>
<tr>
<td>BEST</td>
<td>Alton</td>
<td>none</td>
<td></td>
<td>6</td>
<td>1986</td>
<td>1987</td>
<td>MD</td>
</tr>
<tr>
<td>BIANCHI</td>
<td>Kenneth</td>
<td>Hillside Stranglers</td>
<td>1</td>
<td>12</td>
<td>1977</td>
<td>1979</td>
<td>CA</td>
</tr>
<tr>
<td>BIEGENWALD</td>
<td>Richard</td>
<td>none</td>
<td></td>
<td>6</td>
<td>1958</td>
<td>1982</td>
<td>NY</td>
</tr>
<tr>
<td>BISHOP</td>
<td>Arthur</td>
<td>none</td>
<td></td>
<td>5</td>
<td>1979</td>
<td>1983</td>
<td>UT</td>
</tr>
<tr>
<td>BITTAKER</td>
<td>Lawrence</td>
<td>Murder Mac</td>
<td></td>
<td>1</td>
<td>5</td>
<td>1979</td>
<td>1979</td>
</tr>
<tr>
<td>BONIN</td>
<td>William</td>
<td>Freeway Killer</td>
<td>1</td>
<td>21</td>
<td>1972</td>
<td>1980</td>
<td>CA</td>
</tr>
<tr>
<td>BRADY</td>
<td>Ian</td>
<td>Moors Murderers</td>
<td>1</td>
<td>10</td>
<td>1963</td>
<td>1965</td>
<td>UK</td>
</tr>
<tr>
<td>BRIGGEN</td>
<td>Joseph</td>
<td>none</td>
<td></td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BROOKS</td>
<td>David</td>
<td>none</td>
<td></td>
<td>2</td>
<td>31</td>
<td>1970</td>
<td>1973</td>
</tr>
<tr>
<td>BROOKS</td>
<td>John</td>
<td>none</td>
<td></td>
<td>9</td>
<td>1986</td>
<td>1986</td>
<td>LA</td>
</tr>
<tr>
<td>BROWN</td>
<td>Debra</td>
<td>none</td>
<td></td>
<td>1</td>
<td>8</td>
<td>1984</td>
<td>1984</td>
</tr>
<tr>
<td>BRUDOS</td>
<td>Jerry</td>
<td>Lust Killer</td>
<td></td>
<td>5</td>
<td>1968</td>
<td>1969</td>
<td>OR</td>
</tr>
<tr>
<td>BUNDAY</td>
<td>Thomas</td>
<td>none</td>
<td></td>
<td>5</td>
<td>1979</td>
<td>1981</td>
<td>AK</td>
</tr>
<tr>
<td>BUNDY</td>
<td>Carol</td>
<td>Sunset Strip Slayer</td>
<td>1</td>
<td>6</td>
<td>1980</td>
<td>1980</td>
<td>CA</td>
</tr>
<tr>
<td>BUNDY</td>
<td>Theodore</td>
<td>none</td>
<td></td>
<td>36</td>
<td>1973</td>
<td>1978</td>
<td>WA</td>
</tr>
<tr>
<td>BUONO</td>
<td>Angelo</td>
<td>Hillside Stranglers</td>
<td>1</td>
<td>10</td>
<td>1977</td>
<td>1978</td>
<td>CA</td>
</tr>
<tr>
<td>BUTTS</td>
<td>Vernon</td>
<td>Freeway Killer</td>
<td>1</td>
<td>9</td>
<td>1979</td>
<td>1980</td>
<td>CA</td>
</tr>
<tr>
<td>CARIGNAN</td>
<td>Harvey</td>
<td>Want-Ad Killer</td>
<td>5</td>
<td>1949</td>
<td>1975</td>
<td>MN</td>
<td></td>
</tr>
<tr>
<td>CARPENTER</td>
<td>David</td>
<td>Trailside Killer</td>
<td>7</td>
<td></td>
<td>1979</td>
<td>1981</td>
<td>CA</td>
</tr>
<tr>
<td>CARR</td>
<td>Robert</td>
<td>none</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARSON</td>
<td>Michael</td>
<td>none</td>
<td></td>
<td>1</td>
<td>3</td>
<td>1981</td>
<td>1983</td>
</tr>
<tr>
<td>CARSON</td>
<td>Suzan</td>
<td>none</td>
<td></td>
<td>1</td>
<td>3</td>
<td>1981</td>
<td>1983</td>
</tr>
<tr>
<td>CARTER</td>
<td>Dean</td>
<td>none</td>
<td></td>
<td>6</td>
<td>1983</td>
<td>1984</td>
<td>CA</td>
</tr>
<tr>
<td>CHASE</td>
<td>Richard</td>
<td>Vampire Killer</td>
<td>6</td>
<td></td>
<td>1977</td>
<td>1978</td>
<td>CA</td>
</tr>
<tr>
<td>Surname</td>
<td>Given Name</td>
<td>Media Name</td>
<td>Co-Killer</td>
<td>Murders</td>
<td>Start</td>
<td>End</td>
<td>State</td>
</tr>
<tr>
<td>-------------</td>
<td>------------</td>
<td>-----------------------</td>
<td>-----------</td>
<td>---------</td>
<td>--------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>CHIKATILO</td>
<td>Andrei</td>
<td>Rostov Ripper</td>
<td>55</td>
<td>1978</td>
<td>1990</td>
<td>SR</td>
<td></td>
</tr>
<tr>
<td>CHRISTENSEN</td>
<td>William</td>
<td>none</td>
<td>16</td>
<td>1982</td>
<td>1982</td>
<td>PA</td>
<td></td>
</tr>
<tr>
<td>CHRISTOPHER</td>
<td>Joseph</td>
<td>.22 Caliber Killer</td>
<td>6</td>
<td>1980</td>
<td>1981</td>
<td>NY</td>
<td></td>
</tr>
<tr>
<td>CLARK</td>
<td>Douglas</td>
<td>Sunset Strip Slayer</td>
<td>1</td>
<td>6</td>
<td>1980</td>
<td>1980</td>
<td>CA</td>
</tr>
<tr>
<td>CODE</td>
<td>Nathaniel</td>
<td>none</td>
<td>10</td>
<td>1985</td>
<td>1987</td>
<td>LA</td>
<td></td>
</tr>
<tr>
<td>COLE</td>
<td>Carroll</td>
<td>none</td>
<td>35</td>
<td>1946</td>
<td>1979</td>
<td>NV</td>
<td></td>
</tr>
<tr>
<td>COLEMAN</td>
<td>Alton</td>
<td>none</td>
<td>1</td>
<td>8</td>
<td>1984</td>
<td>1984</td>
<td>OH</td>
</tr>
<tr>
<td>COLLINS</td>
<td>John</td>
<td>Michigan Murderer</td>
<td>8</td>
<td>1967</td>
<td>1969</td>
<td>MI</td>
<td></td>
</tr>
<tr>
<td>COOKS</td>
<td>Jesse</td>
<td>Zebra Murders</td>
<td>4</td>
<td>15</td>
<td>1973</td>
<td>1974</td>
<td>CA</td>
</tr>
<tr>
<td>COPELAND</td>
<td>Faye</td>
<td>none</td>
<td>1</td>
<td>13</td>
<td>1985</td>
<td>1989</td>
<td>MO</td>
</tr>
<tr>
<td>COPELAND</td>
<td>Ray</td>
<td>none</td>
<td>1</td>
<td>13</td>
<td>1985</td>
<td>1989</td>
<td>MO</td>
</tr>
<tr>
<td>CORLL</td>
<td>Dean</td>
<td>Candy Man</td>
<td>2</td>
<td>31</td>
<td>1970</td>
<td>1973</td>
<td>TX</td>
</tr>
<tr>
<td>CORONA</td>
<td>Juan</td>
<td>none</td>
<td>25</td>
<td></td>
<td>1971</td>
<td>1971</td>
<td>CA</td>
</tr>
<tr>
<td>COTTINGHAM</td>
<td>Richard</td>
<td>Mid-Town Torso Killer</td>
<td>6</td>
<td></td>
<td>1977</td>
<td>1980</td>
<td>NY</td>
</tr>
<tr>
<td>CRAINE</td>
<td>Louis</td>
<td>none</td>
<td>4</td>
<td>1985</td>
<td>1987</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>CREECH</td>
<td>Thomas</td>
<td>none</td>
<td>42</td>
<td>1965</td>
<td>1981</td>
<td>OH</td>
<td></td>
</tr>
<tr>
<td>DAHMER</td>
<td>Jeffrey</td>
<td>Milwaukee Cannibal</td>
<td>17</td>
<td>1978</td>
<td>1991</td>
<td>WI</td>
<td></td>
</tr>
<tr>
<td>DANIELSON</td>
<td>Robert</td>
<td>none</td>
<td>5</td>
<td></td>
<td></td>
<td>WI</td>
<td></td>
</tr>
<tr>
<td>DAUGHERTY</td>
<td>Jeffrey</td>
<td>none</td>
<td>5</td>
<td>1976</td>
<td>1976</td>
<td>FL</td>
<td></td>
</tr>
<tr>
<td>DAVIS</td>
<td>Bruce</td>
<td>none</td>
<td>30</td>
<td>1969</td>
<td>1971</td>
<td>NY</td>
<td></td>
</tr>
<tr>
<td>DeSALVO</td>
<td>Albert</td>
<td>Boston Strangler</td>
<td>13</td>
<td>1962</td>
<td>1964</td>
<td>MA</td>
<td></td>
</tr>
<tr>
<td>DIAZ</td>
<td>Robert</td>
<td>none</td>
<td>60</td>
<td>1981</td>
<td>1981</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>DODD</td>
<td>Westley</td>
<td>none</td>
<td>6</td>
<td>1989</td>
<td>1989</td>
<td>WA</td>
<td></td>
</tr>
<tr>
<td>DUFFY</td>
<td>John</td>
<td>Railway Killer</td>
<td>3</td>
<td>1985</td>
<td>1986</td>
<td>UK</td>
<td></td>
</tr>
<tr>
<td>EATON</td>
<td>Dennis</td>
<td>none</td>
<td>4</td>
<td></td>
<td>1989</td>
<td>VA</td>
<td></td>
</tr>
<tr>
<td>EVEANS</td>
<td>Tammy</td>
<td>none</td>
<td>3</td>
<td>1987</td>
<td>1989</td>
<td>IL</td>
<td></td>
</tr>
<tr>
<td>EYLER</td>
<td>Larry</td>
<td>none</td>
<td>23</td>
<td></td>
<td>1982</td>
<td>1984</td>
<td>IL</td>
</tr>
<tr>
<td>FERNANDEZ</td>
<td>Raymond</td>
<td>Lonely Hearts Killers</td>
<td>1</td>
<td>20</td>
<td>1947</td>
<td>1949</td>
<td>NY</td>
</tr>
<tr>
<td>FISCHER</td>
<td>Joseph</td>
<td>none</td>
<td>100</td>
<td>1955</td>
<td>1979</td>
<td>NY</td>
<td></td>
</tr>
<tr>
<td>FISH</td>
<td>Albert</td>
<td>none</td>
<td>15</td>
<td>1910</td>
<td>1934</td>
<td>NY</td>
<td></td>
</tr>
<tr>
<td>FRANKLIN</td>
<td>Joseph</td>
<td>none</td>
<td>4</td>
<td>1977</td>
<td>1980</td>
<td>UT</td>
<td></td>
</tr>
<tr>
<td>GACY</td>
<td>John</td>
<td>none</td>
<td>33</td>
<td>1972</td>
<td>1978</td>
<td>IL</td>
<td></td>
</tr>
<tr>
<td>GALLEGDO</td>
<td>Charlene</td>
<td>none</td>
<td>1</td>
<td>8</td>
<td>1978</td>
<td>1980</td>
<td>CA</td>
</tr>
<tr>
<td>GALLEGDO</td>
<td>Gerald</td>
<td>none</td>
<td>1</td>
<td>10</td>
<td>1978</td>
<td>1980</td>
<td>CA</td>
</tr>
<tr>
<td>GARY</td>
<td>Carlton</td>
<td>Stocking Strangler</td>
<td>9</td>
<td>1970</td>
<td>1978</td>
<td>GA</td>
<td></td>
</tr>
<tr>
<td>GASKINS</td>
<td>Donald</td>
<td>none</td>
<td>100</td>
<td>1953</td>
<td>1982</td>
<td>SC</td>
<td></td>
</tr>
<tr>
<td>GECHT</td>
<td>Robin</td>
<td>Chicago Rippers</td>
<td>3</td>
<td>18</td>
<td>1981</td>
<td>1982</td>
<td>IL</td>
</tr>
<tr>
<td>Surname</td>
<td>Given Name</td>
<td>Media Name</td>
<td>Co-Killer</td>
<td>Murders</td>
<td>Start</td>
<td>End</td>
<td>State</td>
</tr>
<tr>
<td>----------</td>
<td>------------</td>
<td>---------------------</td>
<td>-----------</td>
<td>---------</td>
<td>-------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>GEIN</td>
<td>Ed</td>
<td>none</td>
<td>7</td>
<td>1954</td>
<td>1957</td>
<td>WI</td>
<td></td>
</tr>
<tr>
<td>GLATMAN</td>
<td>Harvey</td>
<td>Lonely-Hearts Killer</td>
<td>3</td>
<td>1957</td>
<td>1958</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>GLAZE</td>
<td>Billy</td>
<td>none</td>
<td>3</td>
<td>1986</td>
<td>1987</td>
<td>MN</td>
<td></td>
</tr>
<tr>
<td>GOHL</td>
<td>Billy</td>
<td>none</td>
<td>39</td>
<td>1909</td>
<td>1912</td>
<td>WA</td>
<td></td>
</tr>
<tr>
<td>GOODE</td>
<td>Arthur</td>
<td>none</td>
<td>4</td>
<td>1976</td>
<td>1976</td>
<td>FL</td>
<td></td>
</tr>
<tr>
<td>GORE</td>
<td>David</td>
<td>none</td>
<td>1</td>
<td>1981</td>
<td>1983</td>
<td>FL</td>
<td></td>
</tr>
<tr>
<td>GRAHAM</td>
<td>Gwendolyn</td>
<td>none</td>
<td>1</td>
<td>1987</td>
<td>1987</td>
<td>MI</td>
<td></td>
</tr>
<tr>
<td>GGRAHAM</td>
<td>Harrison</td>
<td>none</td>
<td>7</td>
<td>1986</td>
<td>1987</td>
<td>PA</td>
<td></td>
</tr>
<tr>
<td>GRANVIEL</td>
<td>Kenneth</td>
<td>none</td>
<td>7</td>
<td>1974</td>
<td>1975</td>
<td>TX</td>
<td></td>
</tr>
<tr>
<td>GREEN</td>
<td>Larry</td>
<td>Zebra Murders</td>
<td>4</td>
<td>15</td>
<td>1973</td>
<td>1974</td>
<td>CA</td>
</tr>
<tr>
<td>GREEN</td>
<td>Ricky</td>
<td>none</td>
<td>4</td>
<td>1985</td>
<td>1986</td>
<td>TX</td>
<td></td>
</tr>
<tr>
<td>GREENWOOD</td>
<td>Vaughn</td>
<td>Skid Row Slasher</td>
<td>11</td>
<td>1964</td>
<td>1975</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>GRETZLER</td>
<td>Douglas</td>
<td>none</td>
<td>1</td>
<td>17</td>
<td>1973</td>
<td>1973</td>
<td>AZ</td>
</tr>
<tr>
<td>GRISSOM</td>
<td>Richard</td>
<td>none</td>
<td>5</td>
<td>1977</td>
<td>1989</td>
<td>KS</td>
<td></td>
</tr>
<tr>
<td>GROVES</td>
<td>Vincent</td>
<td>none</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRUBER</td>
<td>Maria</td>
<td>none</td>
<td>3</td>
<td>39</td>
<td>1982</td>
<td>1989</td>
<td>AU</td>
</tr>
<tr>
<td>GUNNESS</td>
<td>Belle</td>
<td>none</td>
<td>19</td>
<td>1900</td>
<td>1908</td>
<td>IL</td>
<td></td>
</tr>
<tr>
<td>HANCE</td>
<td>William</td>
<td>Forces of Evil</td>
<td>4</td>
<td>1977</td>
<td>1978</td>
<td>GA</td>
<td></td>
</tr>
<tr>
<td>HANSEN</td>
<td>Robert</td>
<td>none</td>
<td>24</td>
<td>1975</td>
<td>1983</td>
<td>AK</td>
<td></td>
</tr>
<tr>
<td>HARRIS</td>
<td>Anthony</td>
<td>Zebra Murders</td>
<td>4</td>
<td>15</td>
<td>1973</td>
<td>1974</td>
<td>CA</td>
</tr>
<tr>
<td>HARVEY</td>
<td>Donald</td>
<td>none</td>
<td>55</td>
<td>1970</td>
<td>1987</td>
<td>OH</td>
<td></td>
</tr>
<tr>
<td>HATCHER</td>
<td>Charles</td>
<td>none</td>
<td>16</td>
<td>1969</td>
<td>1982</td>
<td>MO</td>
<td></td>
</tr>
<tr>
<td>HEIRENS</td>
<td>William</td>
<td>none</td>
<td>4</td>
<td>1945</td>
<td>1946</td>
<td>IL</td>
<td></td>
</tr>
<tr>
<td>HENDERSON</td>
<td>Robert</td>
<td>none</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HENLEY</td>
<td>Elmer</td>
<td>none</td>
<td>2</td>
<td>31</td>
<td>1970</td>
<td>1973</td>
<td>TX</td>
</tr>
<tr>
<td>HINDLEY</td>
<td>Myra</td>
<td>Moors Murderers</td>
<td>1</td>
<td>10</td>
<td>1963</td>
<td>1965</td>
<td>UK</td>
</tr>
<tr>
<td>HOCH</td>
<td>Johann</td>
<td>none</td>
<td>25</td>
<td>1890</td>
<td>1905</td>
<td>IL</td>
<td></td>
</tr>
<tr>
<td>HOLLADAY</td>
<td>Glenn</td>
<td>none</td>
<td>4</td>
<td>1986</td>
<td>1986</td>
<td>AL</td>
<td></td>
</tr>
<tr>
<td>HOLLAND</td>
<td>James</td>
<td>none</td>
<td>6</td>
<td>1967</td>
<td>1987</td>
<td>UT</td>
<td></td>
</tr>
<tr>
<td>HUMPHREY</td>
<td>Edward</td>
<td>none</td>
<td>5</td>
<td>1990</td>
<td>1990</td>
<td>FL</td>
<td></td>
</tr>
<tr>
<td>HUNTER</td>
<td>Richard</td>
<td>none</td>
<td>4</td>
<td>1986</td>
<td>1986</td>
<td>GA</td>
<td></td>
</tr>
<tr>
<td>JENNINGS</td>
<td>Wilbur</td>
<td>none</td>
<td>4</td>
<td>1983</td>
<td>1984</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>JOHNSON</td>
<td>Martha</td>
<td>none</td>
<td>4</td>
<td>1977</td>
<td>1982</td>
<td>GA</td>
<td></td>
</tr>
<tr>
<td>JONES</td>
<td>Genene</td>
<td>none</td>
<td>11</td>
<td>1981</td>
<td>1982</td>
<td>TX</td>
<td></td>
</tr>
<tr>
<td>JOUBERT</td>
<td>John</td>
<td>none</td>
<td>3</td>
<td>1982</td>
<td>1983</td>
<td>NE</td>
<td></td>
</tr>
<tr>
<td>JUDY</td>
<td>Steven</td>
<td>none</td>
<td>7</td>
<td>1973</td>
<td>1979</td>
<td>IN</td>
<td></td>
</tr>
<tr>
<td>JUSTUS</td>
<td>Buddy</td>
<td>none</td>
<td>3</td>
<td>1978</td>
<td>1978</td>
<td>FL</td>
<td></td>
</tr>
<tr>
<td>Surname</td>
<td>Given Name</td>
<td>Media Name</td>
<td>Co-Killer</td>
<td>Murders</td>
<td>Start</td>
<td>End</td>
<td>State</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
<td>---------------------</td>
<td>-----------</td>
<td>---------</td>
<td>--------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>KEARNEY</td>
<td>Patrick</td>
<td>Trash-Bag Killer</td>
<td>28</td>
<td>1968</td>
<td>1977</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>KELBACH</td>
<td>Walter</td>
<td>none</td>
<td>1</td>
<td>1966</td>
<td>1966</td>
<td>UT</td>
<td></td>
</tr>
<tr>
<td>KEMPER</td>
<td>Edmund</td>
<td>Coed Killer</td>
<td>10</td>
<td>1964</td>
<td>1973</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>KIBBE</td>
<td>Roger</td>
<td>1-5 Strangler</td>
<td>7</td>
<td>1986</td>
<td>1987</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>KIRKER</td>
<td>James</td>
<td>none</td>
<td>300</td>
<td>1852</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KOEDATICH</td>
<td>James</td>
<td>none</td>
<td>3</td>
<td></td>
<td></td>
<td>FL</td>
<td></td>
</tr>
<tr>
<td>KOKORALEIS</td>
<td>Andrew</td>
<td>Chicago Rippers</td>
<td>3</td>
<td>18</td>
<td>1981</td>
<td>1982</td>
<td>IL</td>
</tr>
<tr>
<td>KOKORALEIS</td>
<td>Thomas</td>
<td>Chicago Rippers</td>
<td>3</td>
<td>18</td>
<td>1981</td>
<td>1982</td>
<td>IL</td>
</tr>
<tr>
<td>KRAFT</td>
<td>Randy</td>
<td>Score-Card Killer</td>
<td>67</td>
<td>1972</td>
<td>1983</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>KURTEN</td>
<td>Peter</td>
<td>Monster of Dusseldorf</td>
<td>12</td>
<td>1892</td>
<td>1930</td>
<td>GE</td>
<td></td>
</tr>
<tr>
<td>LAKE</td>
<td>Leonard</td>
<td>none</td>
<td>1</td>
<td>25</td>
<td>1983</td>
<td>1985</td>
<td>CA</td>
</tr>
<tr>
<td>LANCE</td>
<td>Myron</td>
<td>none</td>
<td>1</td>
<td>6</td>
<td>1966</td>
<td>1966</td>
<td>UT</td>
</tr>
<tr>
<td>LASSOR</td>
<td>Raymond</td>
<td>none</td>
<td>3</td>
<td>1984</td>
<td>1984</td>
<td>RI</td>
<td></td>
</tr>
<tr>
<td>LEIDOLF</td>
<td>Irene</td>
<td>none</td>
<td>3</td>
<td>39</td>
<td>1982</td>
<td>1989</td>
<td>AU</td>
</tr>
<tr>
<td>LONG</td>
<td>Bobby Joe</td>
<td>none</td>
<td>10</td>
<td></td>
<td>1984</td>
<td>1984</td>
<td>FL</td>
</tr>
<tr>
<td>LONG</td>
<td>Royal</td>
<td>none</td>
<td>3</td>
<td>1981</td>
<td>1984</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>LOPEZ</td>
<td>Roberto</td>
<td>none</td>
<td>3</td>
<td></td>
<td>1983</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>LUCAS</td>
<td>Henry Lee</td>
<td>none</td>
<td>1</td>
<td>100</td>
<td>1960</td>
<td>1982</td>
<td>MI</td>
</tr>
<tr>
<td>MACEK</td>
<td>Richard</td>
<td>none</td>
<td>8</td>
<td>1974</td>
<td>1974</td>
<td>IL</td>
<td></td>
</tr>
<tr>
<td>MANSFIELD</td>
<td>Billy</td>
<td>none</td>
<td>5</td>
<td>1975</td>
<td>1980</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>MARCUS</td>
<td>Jerry</td>
<td>none</td>
<td>7</td>
<td>1971</td>
<td>1987</td>
<td>MS</td>
<td></td>
</tr>
<tr>
<td>MARQUETTE</td>
<td>Richard</td>
<td>none</td>
<td>6</td>
<td>1961</td>
<td>1975</td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>MATHURIN</td>
<td>Jean-Thierry</td>
<td>Monster of Montmartre</td>
<td>1</td>
<td>38</td>
<td>1984</td>
<td>1987</td>
<td>FR</td>
</tr>
<tr>
<td>MAXWELL</td>
<td>Bobby Joe</td>
<td>Skid Row Stabber</td>
<td>10</td>
<td>1978</td>
<td>1979</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>MAYER</td>
<td>Stefanie</td>
<td>none</td>
<td>3</td>
<td>39</td>
<td>1982</td>
<td>1989</td>
<td>AU</td>
</tr>
<tr>
<td>McCRARY</td>
<td>Danny</td>
<td>none</td>
<td>2</td>
<td>22</td>
<td>1971</td>
<td>1972</td>
<td>CO</td>
</tr>
<tr>
<td>McCRARY</td>
<td>Sherman</td>
<td>none</td>
<td>2</td>
<td>22</td>
<td>1971</td>
<td>1972</td>
<td>CO</td>
</tr>
<tr>
<td>McKNIGHT</td>
<td>Anthony</td>
<td>none</td>
<td>7</td>
<td>1985</td>
<td>1986</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>MICHAESVICH</td>
<td>Gennaday</td>
<td>none</td>
<td>36</td>
<td>1973</td>
<td>1988</td>
<td>SR</td>
<td></td>
</tr>
<tr>
<td>MILEY</td>
<td>Gregory</td>
<td>none</td>
<td>5</td>
<td></td>
<td></td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>MILLER</td>
<td>Don</td>
<td>none</td>
<td>4</td>
<td>1980</td>
<td>1981</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>MIYAZAKI</td>
<td>Tsutomu</td>
<td>none</td>
<td>3</td>
<td>1988</td>
<td>1989</td>
<td>JP</td>
<td></td>
</tr>
<tr>
<td>MOORE</td>
<td>Manuel</td>
<td>Zebra Murders</td>
<td>4</td>
<td>15</td>
<td>1973</td>
<td>1974</td>
<td>CA</td>
</tr>
<tr>
<td>MORIN</td>
<td>Stephan</td>
<td>none</td>
<td>30</td>
<td>1981</td>
<td>1981</td>
<td>TX</td>
<td></td>
</tr>
<tr>
<td>MUGGETT</td>
<td>Hermann</td>
<td>H. H. Holmes</td>
<td>200</td>
<td>1891</td>
<td>1896</td>
<td>IL</td>
<td></td>
</tr>
<tr>
<td>MULLIN</td>
<td>Herbert</td>
<td>none</td>
<td>13</td>
<td>1972</td>
<td>1973</td>
<td>CA</td>
<td></td>
</tr>
<tr>
<td>MURRELL</td>
<td>John</td>
<td>none</td>
<td>500</td>
<td>1835</td>
<td></td>
<td>TN</td>
<td></td>
</tr>
<tr>
<td>Surname</td>
<td>Given Name</td>
<td>Media Name</td>
<td>Co-Killer</td>
<td>Murders</td>
<td>Start</td>
<td>End</td>
<td>State</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
<td>-----------------------</td>
<td>-----------</td>
<td>---------</td>
<td>-------</td>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>NASH</td>
<td>Steven</td>
<td>none</td>
<td>6</td>
<td></td>
<td>1958</td>
<td></td>
<td>CA</td>
</tr>
<tr>
<td>NELSON</td>
<td>Earle</td>
<td>Gorilla Murderer</td>
<td>25</td>
<td></td>
<td>1926</td>
<td>1927</td>
<td>CA</td>
</tr>
<tr>
<td>NG</td>
<td>Charles</td>
<td>none</td>
<td>1</td>
<td>25</td>
<td>1981</td>
<td>1985</td>
<td>CA</td>
</tr>
<tr>
<td>NILSEN</td>
<td>Dennis</td>
<td>none</td>
<td>15</td>
<td></td>
<td>1978</td>
<td>1983</td>
<td>UK</td>
</tr>
<tr>
<td>NORRIS</td>
<td>Roy</td>
<td>Murder Mac</td>
<td>1</td>
<td>50</td>
<td>1979</td>
<td>1979</td>
<td>CA</td>
</tr>
<tr>
<td>O’NEALL</td>
<td>Darren</td>
<td>none</td>
<td>6</td>
<td></td>
<td>1985</td>
<td>1987</td>
<td>WA</td>
</tr>
<tr>
<td>OLSON</td>
<td>Clifford</td>
<td>none</td>
<td>11</td>
<td></td>
<td>1980</td>
<td>1981</td>
<td>BC</td>
</tr>
<tr>
<td>OWEN</td>
<td>Duane</td>
<td>none</td>
<td>5</td>
<td></td>
<td>1984</td>
<td>1984</td>
<td>CO</td>
</tr>
<tr>
<td>PANZRAM</td>
<td>Carl</td>
<td>none</td>
<td>22</td>
<td></td>
<td>1923</td>
<td>1929</td>
<td>KS</td>
</tr>
<tr>
<td>PAULIN</td>
<td>Thierry</td>
<td>Monster of Montmartre</td>
<td>1</td>
<td>38</td>
<td>1984</td>
<td>1987</td>
<td>FR</td>
</tr>
<tr>
<td>PENNELL</td>
<td>Steven</td>
<td>none</td>
<td>5</td>
<td></td>
<td>1987</td>
<td>1988</td>
<td>DE</td>
</tr>
<tr>
<td>PLAYER</td>
<td>Michael</td>
<td>Skid Row Slayer</td>
<td>11</td>
<td></td>
<td>1986</td>
<td>1986</td>
<td>CA</td>
</tr>
<tr>
<td>PONTE</td>
<td>Kenneth</td>
<td>none</td>
<td>9</td>
<td></td>
<td>1988</td>
<td>1989</td>
<td>MA</td>
</tr>
<tr>
<td>PRICE</td>
<td>Craig</td>
<td>none</td>
<td>4</td>
<td></td>
<td>1987</td>
<td>1989</td>
<td>RI</td>
</tr>
<tr>
<td>PUENTE</td>
<td>Dorothea</td>
<td>none</td>
<td>8</td>
<td></td>
<td>1985</td>
<td>1988</td>
<td>CA</td>
</tr>
<tr>
<td>RAHMAN</td>
<td>Yusef</td>
<td>none</td>
<td>4</td>
<td></td>
<td>1989</td>
<td>1989</td>
<td>NY</td>
</tr>
<tr>
<td>RALSTON</td>
<td>Larry</td>
<td>none</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>OH</td>
</tr>
<tr>
<td>RAMIREZ</td>
<td>Richard</td>
<td>Night Stalker</td>
<td>18</td>
<td></td>
<td>1984</td>
<td>1985</td>
<td>CA</td>
</tr>
<tr>
<td>RHOADES</td>
<td>Paul</td>
<td>none</td>
<td>3</td>
<td></td>
<td>1987</td>
<td>1987</td>
<td>ID</td>
</tr>
<tr>
<td>RIFKIN</td>
<td>Joel</td>
<td>none</td>
<td>17</td>
<td></td>
<td>1989</td>
<td>1993</td>
<td>NY</td>
</tr>
<tr>
<td>RIOS</td>
<td>Joe</td>
<td>none</td>
<td>4</td>
<td></td>
<td>1987</td>
<td>1987</td>
<td>TX</td>
</tr>
<tr>
<td>RISSELL</td>
<td>Monte</td>
<td>none</td>
<td>5</td>
<td></td>
<td>1975</td>
<td>1976</td>
<td>VA</td>
</tr>
<tr>
<td>ROGERS</td>
<td>Dayton</td>
<td>Molalla Forest Killer</td>
<td>7</td>
<td></td>
<td>1972</td>
<td>1987</td>
<td>OR</td>
</tr>
<tr>
<td>ROSS</td>
<td>Michael</td>
<td>none</td>
<td>6</td>
<td></td>
<td>1982</td>
<td>1984</td>
<td>CT</td>
</tr>
<tr>
<td>ROSS</td>
<td>Rickey</td>
<td>Strawberry Killer</td>
<td>3</td>
<td></td>
<td>1988</td>
<td>1988</td>
<td>CA</td>
</tr>
<tr>
<td>SAPP</td>
<td>John</td>
<td>none</td>
<td>10</td>
<td></td>
<td>1975</td>
<td>1985</td>
<td>CA</td>
</tr>
<tr>
<td>SHAWCROSS</td>
<td>Arthur</td>
<td>none</td>
<td>13</td>
<td></td>
<td>1972</td>
<td>1990</td>
<td>NY</td>
</tr>
<tr>
<td>SIEBERT</td>
<td>Daniel</td>
<td>none</td>
<td>13</td>
<td></td>
<td>1979</td>
<td>1986</td>
<td>AL</td>
</tr>
<tr>
<td>SILKA</td>
<td>Michael</td>
<td>none</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>AK</td>
</tr>
<tr>
<td>SILVA</td>
<td>Mauricio</td>
<td>none</td>
<td>4</td>
<td></td>
<td>1978</td>
<td>1984</td>
<td>CA</td>
</tr>
<tr>
<td>SIMON</td>
<td>J. C.</td>
<td>Zebra Murders</td>
<td>4</td>
<td>15</td>
<td>1973</td>
<td>1974</td>
<td>CA</td>
</tr>
<tr>
<td>SMITH</td>
<td>Lemuel</td>
<td>none</td>
<td>6</td>
<td></td>
<td>1958</td>
<td>1981</td>
<td>NY</td>
</tr>
<tr>
<td>SMITH</td>
<td>Nathaniel</td>
<td>none</td>
<td>4</td>
<td></td>
<td>1982</td>
<td></td>
<td>KS</td>
</tr>
<tr>
<td>SMITH</td>
<td>William</td>
<td>none</td>
<td>8</td>
<td></td>
<td>1981</td>
<td>1984</td>
<td>OR</td>
</tr>
<tr>
<td>SNYDER</td>
<td>David</td>
<td>none</td>
<td>4</td>
<td></td>
<td>1982</td>
<td>1984</td>
<td>MD</td>
</tr>
<tr>
<td>SOLOMON</td>
<td>Morris</td>
<td>none</td>
<td>7</td>
<td></td>
<td>1986</td>
<td>1987</td>
<td>CA</td>
</tr>
<tr>
<td>SPENCER</td>
<td>Timothy</td>
<td>Southside Strangler</td>
<td>5</td>
<td></td>
<td>1984</td>
<td>1987</td>
<td>VA</td>
</tr>
</tbody>
</table>

409
<table>
<thead>
<tr>
<th>Surname</th>
<th>Given Name</th>
<th>Media Name</th>
<th>Co-Killer</th>
<th>Murders</th>
<th>Start</th>
<th>End</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPISAK</td>
<td>Frank</td>
<td>none</td>
<td>3</td>
<td>18</td>
<td>1982</td>
<td>1982</td>
<td>OH</td>
</tr>
<tr>
<td>SPREITZER</td>
<td>Edward</td>
<td>Chicago Rippers</td>
<td>1</td>
<td>9</td>
<td>1978</td>
<td>1978</td>
<td>IL</td>
</tr>
<tr>
<td>STAFFORD</td>
<td>Roger</td>
<td>none</td>
<td>1</td>
<td>9</td>
<td>1978</td>
<td>1978</td>
<td>OK</td>
</tr>
<tr>
<td>STAFFORD</td>
<td>Vern</td>
<td>none</td>
<td>1</td>
<td>9</td>
<td>1978</td>
<td>1978</td>
<td>OK</td>
</tr>
<tr>
<td>STANO</td>
<td>Gerald</td>
<td>none</td>
<td>41</td>
<td></td>
<td>1969</td>
<td>1980</td>
<td>FL</td>
</tr>
<tr>
<td>STEELMAN</td>
<td>Willie</td>
<td>none</td>
<td>1</td>
<td>17</td>
<td>1973</td>
<td>1973</td>
<td>AZ</td>
</tr>
<tr>
<td>SUTCLIFFE</td>
<td>Peter</td>
<td>Yorkshire Ripper</td>
<td>13</td>
<td></td>
<td>1975</td>
<td>1980</td>
<td>UK</td>
</tr>
<tr>
<td>TAYLOR</td>
<td>Raymond</td>
<td>none</td>
<td>2</td>
<td>22</td>
<td>1971</td>
<td>1972</td>
<td>CO</td>
</tr>
<tr>
<td>TENNESON</td>
<td>Michael</td>
<td>none</td>
<td>5</td>
<td></td>
<td>1987</td>
<td>1987</td>
<td>CO</td>
</tr>
<tr>
<td>THREINEN</td>
<td>David</td>
<td>none</td>
<td>6</td>
<td></td>
<td>1975</td>
<td>1975</td>
<td>SK</td>
</tr>
<tr>
<td>TINNING</td>
<td>Marybeth</td>
<td>none</td>
<td>9</td>
<td></td>
<td>1972</td>
<td>1985</td>
<td>NY</td>
</tr>
<tr>
<td>TOOLE</td>
<td>Ottis</td>
<td>none</td>
<td>1</td>
<td>25</td>
<td>1961</td>
<td>1983</td>
<td>FL</td>
</tr>
<tr>
<td>TOPPAN</td>
<td>Jane</td>
<td>none</td>
<td>31</td>
<td></td>
<td>1880</td>
<td>1901</td>
<td>MA</td>
</tr>
<tr>
<td>TRAVAGLIA</td>
<td>Michael</td>
<td>none</td>
<td>4</td>
<td></td>
<td>1980</td>
<td></td>
<td>PA</td>
</tr>
<tr>
<td>TRIMBOLI</td>
<td>Ronald</td>
<td>none</td>
<td>3</td>
<td></td>
<td>1985</td>
<td>1985</td>
<td>TX</td>
</tr>
<tr>
<td>TUCHLIN</td>
<td>Pawel</td>
<td>none</td>
<td>9</td>
<td></td>
<td>1979</td>
<td>1983</td>
<td>PO</td>
</tr>
<tr>
<td>UNSUB</td>
<td>Aurora Killings</td>
<td>none</td>
<td>4</td>
<td></td>
<td>1984</td>
<td>1984</td>
<td>CO</td>
</tr>
<tr>
<td>UNSUB</td>
<td>Baltimore Murders</td>
<td></td>
<td>5</td>
<td></td>
<td>1987</td>
<td></td>
<td>MD</td>
</tr>
<tr>
<td>UNSUB</td>
<td>BTK Killer</td>
<td></td>
<td>7</td>
<td></td>
<td>1974</td>
<td>1979</td>
<td>KS</td>
</tr>
<tr>
<td>UNSUB</td>
<td>Fort Worth Killings</td>
<td></td>
<td>9</td>
<td></td>
<td>1984</td>
<td>1985</td>
<td>TX</td>
</tr>
<tr>
<td>UNSUB</td>
<td>Green River Killer</td>
<td></td>
<td>49</td>
<td></td>
<td>1982</td>
<td>1984</td>
<td>WA</td>
</tr>
<tr>
<td>UNSUB</td>
<td>Jack the Ripper</td>
<td></td>
<td>5</td>
<td></td>
<td>1888</td>
<td>1888</td>
<td>UK</td>
</tr>
<tr>
<td>UNSUB</td>
<td>Redhead Murders</td>
<td></td>
<td>6</td>
<td></td>
<td>1984</td>
<td>1985</td>
<td>TN</td>
</tr>
<tr>
<td>UNSUB</td>
<td>Salt Lake City Murders</td>
<td></td>
<td>3</td>
<td></td>
<td>1986</td>
<td></td>
<td>UT</td>
</tr>
<tr>
<td>UNSUB</td>
<td>San Mateo Killings</td>
<td></td>
<td>5</td>
<td></td>
<td>1980</td>
<td>1985</td>
<td>CA</td>
</tr>
<tr>
<td>UNSUB</td>
<td>Skid Row Killer</td>
<td></td>
<td>9</td>
<td></td>
<td>1974</td>
<td>1975</td>
<td>CA</td>
</tr>
<tr>
<td>UNSUB</td>
<td>Skid Row Slasher</td>
<td></td>
<td>10</td>
<td></td>
<td>1987</td>
<td></td>
<td>CA</td>
</tr>
<tr>
<td>UNSUB</td>
<td>Southside Slayer</td>
<td></td>
<td>17</td>
<td></td>
<td>1983</td>
<td>1987</td>
<td>CA</td>
</tr>
<tr>
<td>UNSUB</td>
<td>Torso Murderer</td>
<td></td>
<td>18</td>
<td></td>
<td>1934</td>
<td>1938</td>
<td>OH</td>
</tr>
<tr>
<td>UNSUB</td>
<td>Zodiac Killer</td>
<td></td>
<td>37</td>
<td></td>
<td>1968</td>
<td>1969</td>
<td>CA</td>
</tr>
<tr>
<td>WAGNER</td>
<td>Waltraud</td>
<td>none</td>
<td>3</td>
<td></td>
<td>1982</td>
<td>1989</td>
<td>AU</td>
</tr>
<tr>
<td>WALKER</td>
<td>Gary</td>
<td>none</td>
<td>5</td>
<td></td>
<td>1984</td>
<td>1984</td>
<td>OK</td>
</tr>
<tr>
<td>WASHINGTON</td>
<td>David</td>
<td>none</td>
<td>3</td>
<td></td>
<td>1976</td>
<td></td>
<td>FL</td>
</tr>
<tr>
<td>WATERFIELD</td>
<td>Frederick</td>
<td>none</td>
<td>1</td>
<td>6</td>
<td>1981</td>
<td>1983</td>
<td>FL</td>
</tr>
<tr>
<td>WATTS</td>
<td>Coral</td>
<td>Sunday Morning Slasher</td>
<td>19</td>
<td></td>
<td>1979</td>
<td>1982</td>
<td>TX</td>
</tr>
<tr>
<td>WHISENHANT</td>
<td>Thomas</td>
<td>none</td>
<td>4</td>
<td></td>
<td>1963</td>
<td>1976</td>
<td></td>
</tr>
<tr>
<td>WILDER</td>
<td>Christopher</td>
<td>none</td>
<td>12</td>
<td></td>
<td>1984</td>
<td>1984</td>
<td>FL</td>
</tr>
</tbody>
</table>

410
### Table A-1. FBI Serial Murderer Macrolevel Data Set.94

<table>
<thead>
<tr>
<th>Surname</th>
<th>Given Name</th>
<th>Media Name</th>
<th>Co-Killer</th>
<th>Murders</th>
<th>Start</th>
<th>End</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>WILLIAMS</td>
<td>Wayne</td>
<td>Atlanta Child Murderer</td>
<td></td>
<td>29</td>
<td>1979</td>
<td>1981</td>
<td>GA</td>
</tr>
<tr>
<td>WOOD</td>
<td>Catherine</td>
<td>none</td>
<td></td>
<td>1</td>
<td>1987</td>
<td>1987</td>
<td>MI</td>
</tr>
<tr>
<td>WOODFIELD</td>
<td>Randall</td>
<td>I-5 Killer</td>
<td></td>
<td>18</td>
<td>1979</td>
<td>1981</td>
<td>WA</td>
</tr>
<tr>
<td>WUORNOS</td>
<td>Aileen</td>
<td>none</td>
<td></td>
<td>7</td>
<td>1989</td>
<td>1990</td>
<td>FL</td>
</tr>
</tbody>
</table>

94 UNSUB means “unknown subject” (i.e., no one has yet been charged for the murders). Media Name – refers to the moniker or nickname, if any, used by the media and press to describe the serial killer or the murders. Co-Killer – lists the number of accomplices, if any, in the murders. Murders – lists the number of victims that the serial murderer is suspected of having killed. Start – refers to the year of the first known murder. End – refers to the year of the last known murder. State – lists one of the U.S. states, Canadian provinces, or countries that the serial killer is known to have murdered in (in some cases the killer operated in more than one area). The official two-letter U.S. Postal Service or Canada Post abbreviations are used. The following letter codes were used for those cases where the murders occurred outside of the United States or Canada: AU (Austria); EC (Ecuador); FR (France); GE (Germany); JP (Japan); PO (Poland); and SR (USSR).
APPENDIX B

DATA CODING FORMS
PHD DATA CODING FORM #1: SERIAL KILLERS

1. Sequential Number  __ __

2. Surname ____________________________________________

3. Given Names __________________________________________

4. Moniker _____________________________________________

5. Sex  1 Male  2 Female

6. Total Number of Victims  __ __

7. Total Number of Locations  __ __ __

8. Start Date  __.__.__.__.__

9. End Date  __.__.__.__.__

10. Degree of Organization

   1 Organized  2 Somewhat Organized  3 Mixed

   4 Somewhat Disorganized  5 Disorganized
11. Typology

1 Visionary  2 Mission-Oriented  3 Lust
4 Thrill  5 Comfort  6 Power/Control-Oriented

12. Residence Type

1 Detached House  2 Semi-Detached House  3 Apartment  4 Hotel/Motel
5 Rooming/Lodging House  6 Trailer  7 Institution  8 Transient  9 Homeless

13. Residence Address

14. Residence City

15. Residence State  __  __

16. Residence X Coordinate  __  __

17. Residence Y Coordinate  __  __

18. Workplace Type

19. Workplace Address

20. Workplace City

21. Workplace State  __  __
22. Workplace X Coordinate  __  

23. Workplace Y Coordinate  __  

24. Scale (km/unit)  ___ ___ ___  

25. Data File  mur ___ ___ .dat  

26. Comments  ____________________________________________  

27. References  ____________________________________________  

415
PHD DATA CODING FORM #2: SERIAL MURDER VICTIMS

1. Sequential Number

2. Surname

3. Sex  
   1 Male  2 Female

4. Victim/Killer Relationship
   1 Stranger  2 Casual Acquaintance  3 Known

5. Killer Selection
   1 Nonrandom/Patterned  2 Random/Nonpatterned

6. Victim Traits
   1 Specific  2 Nonspecific

7. Victim Activity

   01 At Home  02 At Work  03 Commuting  04 Walking/Jogging

   05 Hitchhiking  06 Other Travel  07 Visiting Friend  08 Outdoor Recreation

   09 At Bar/Nightclub  10 At Other Social Event  11 Prostitution

8. Killer Hunting Style

   1 Hunter  2 Poacher  3 Stalker  4 Troller  5 Trapper
9. Killer Approach

1. Confidence Approach  
2. Surprise Attack  
3. Blitz Assault

10. Control Method

1. Firearm  
2. Knife  
3. Blunt Instrument  
4. Strangulation

5. Physical Force  
6. Intoxicant  
7. Threat

8. Blitz Attack (Victim Immediately Killed)

11. Murder Method

1. Firearm  
2. Knife  
3. Blunt Instrument

4. Strangulation  
5. Physical Force  
6. Poison

12. Crime Location Set

1. E→A→M→D  
2. E→A→MD  
3. E→AM→D  
4. EA→M→D

5. EA→MD  
6. E→AMD  
7. EAM→D  
8. EAMD

13. Attempt To Hide Body

1. Displayed  
2. Dumped  
3. Other Not Hidden

4. Casually Hidden  
5. Well Hidden

14. Linked  
1. Linked  
2. Unlinked

15. Comments

417
PHD DATA CODING FORM #3: SERIAL MURDER LOCATIONS

1. Sequential Number

2. Crime Location Type
   1 Location Victim Last Seen  2 Encounter Site  3 Attack Site
   4 Murder Scene  5 Body Dump Site  6 Vehicle Recovery Site
   7 Found Evidence Site  8 Witness Site

3. Crime Location Address

4. Crime Location City

5. Crime Location State

6. Crime Location X Coordinate

7. Crime Location Y Coordinate

8. Crime Location Known During Police Investigation  1 Yes  2 No

418
9. Area Land Use

1 Residential  2 Commercial  3 Industrial  4 Institutional  
5 Park  6 Rural/Agricultural  7 Wilderness/Uninhabited

10. Site Description

01 Residence  02 Hotel/Motel  03 Public Building  04 School/Educational  05 Business/Shopping Site  06 Entertainment Site  
07 Red-Light Zone  08 Vehicle  09 Public Transportation  10 Private Yard  11 Parking Lot  12 Street/Sidewalk  
13 Alley/Lane/Pathway/Trail  14 Highway/Ditch  15 Park  16 Farm/Field/Open Area  17 River/Lake/Marsh  18 Forest/Woods  
19 Hills/Mountains  20 Desert/Wasteland

11. Site Classification

1 Inside Private  2 Inside Semi-Public  3 Inside Public  
4 Outside Private  5 Outside Semi-Public  6 Outside Public

12. Date  ___.__.____

13. Time Arrived ____:____  To Time Left ____:____ =  

Total Time At Scene ____:____
14. Killer Travel Method  1 Vehicle  2 Public Transportation  3 On Foot

15. Victim or Killer Residence
   1 Killer Residence  2 Victim Residence  3 Both  4 Neither

16. Comments  ____________________________________________________________
APPENDIX C

DATA CODING GUIDELINES
Form #1: Serial Killers

This coding form is used for information about the serial killer. In cases of multiple offenders, use a separate Form #1 for each killer. If the information does not fit into one of the listed categories code as 0 or 00 (Other) as appropriate, and explain in the comments section. If the information is unknown or not available, code as 9 or 99 (Unknown) as appropriate. Leave blank if the question is not applicable.

1. Sequential Number (numeric, 2 digits)

   Code the 2 digit sequential number of the serial killer case. In cases of multiple offenders, distinguish between the killers by the use of a letter suffix (e.g., 12a, 12b).

2. Surname (alphanumeric, unlimited)

   Code the surname of the serial killer.
3. Given Names (alphanumeric, unlimited)

   Code the given name(s) of the serial killer.

4. Moniker (alphanumeric, unlimited)

   Code the moniker or media nickname of the serial killer (e.g., *Yorkshire Ripper*).

5. Sex (circle relevant number)

   Code the sex of the serial killer.

6. Total Number of Victims (numeric, 2 digits)

   Code the total number of victims reported to have been attacked by the serial killer. This is equivalent to the total number of Form #2s associated with the serial killer.

7. Total Number of Locations (numeric, 3 digits)

   Code the total number of locations associated with the serial killer. This is equal to the sum of the number of different locations connected to each of the serial killer’s victims (i.e., equivalent to the total number of Form #3s associated with the serial killer).
8. Start Date (numeric, 6 digits)

Code the date by year first, the month, then day (e.g., November 21, 1988 is coded as 88.11.21). The start date is the date of encounter with the first of the serial killer’s victims. If this information is not known, leave blank.

9. End Date (numeric, 6 digits)

Code the date by year first, the month, then day (e.g., May 17, 1991 is coded as 91.05.17). The end date is the date of body or vehicle dump for the last of the serial killer’s victims. If this information is not known, leave blank.

10. Degree of Organization (circle relevant number)

Code the degree of organization shown by the serial killer in the criminal behaviour exhibited in the murders and their crime scenes.

11. Typology (circle relevant number)

Code the type of serial killer using the typology of Holmes and De Burger (1988).
12. Residence Type (circle relevant number)

Code the type of residence occupied by the killer.

13. Residence Address (alphanumeric, unlimited)

Code the address for the serial killer’s residence in the following order: (1) apartment number (if applicable); (2) street address; (3) street name; and (4) street type (e.g., #202-1957 Main St.). If the exact street address is not known, record the cross streets or the best available locational information. Use the residence of the serial killer during the time of the murders. If the serial killer lived in more than one residence during this period, separate the different residence addresses with slashes. If the serial killer was transient, indicate this and do not code a residence address.

14. Residence City (alphanumeric, unlimited)

Code the city of residence for the serial killer. Use the city that the serial killer lived in during the time of the murders. If the serial killer lived in more than one city during this period, separate the different residence cities with slashes.
15. Residence State (alphanumeric, 2 letters)

Code the state or province of residence for the serial killer with the official U.S. Postal Service two-letter abbreviation (e.g., code Washington as WA, and British Columbia as BC). If the location is in the United Kingdom, code as UK. Use the state or province that the serial killer lived in during the time of the murders. If the serial killer lived in more than one state or province during this period, separate the different residence states or provinces with slashes.

16. Residence X Coordinate (numeric, 2 digits)

Code the X coordinate of the serial killer’s residence as determined from the crime sites map. This number should usually lie in the range between 0 and 100. If this information is not known, leave blank.

17. Residence Y Coordinate (numeric, 2 digits)

Code the Y coordinate of the serial killer’s residence as determined from the crime sites map. This number should usually lie in the range between 0 and 100. If this information is not known, leave blank.
18. Workplace Type (alphanumeric, unlimited)

Code the serial killer’s type of workplace in a manner that describes his or her occupation (e.g., Garage, Sales Office, Owner Construction Company, etc.) If the serial killer did not work, code as appropriate (e.g., Retired, Unemployed, On Welfare, etc.).

19. Workplace Address (alphanumeric, unlimited)

Code the address for the serial killer’s workplace in the following order: (1) apartment number (if applicable); (2) street address; (3) street name; and (4) street type (e.g., #318-3651 Main St.). If the exact street address is not known, record the cross streets or the best available locational information. Use the workplace of the serial killer during the time of the murders. If the serial killer worked in more than one place during this period, separate the different workplace addresses with slashes. If the serial killer did not hold a steady job, indicate this and do not code a workplace address.

20. Workplace City (alphanumeric, unlimited)

Code the city of work for the serial killer. Use the city that the serial killer worked in during the time of the murders. If the serial killer worked in
more than one city during this period, separate the different workplace cities with slashes.

21. Workplace State (alphanumeric, unlimited)

Code the state or province of work for the serial killer with the official U.S. Postal Service two-letter abbreviation (e.g., code Washington as WA, and British Columbia as BC). If the location is in the United Kingdom, code as UK. Use the state or province that the serial killer worked in during the time of the murders. If the serial killer worked in more than one state or province during this period, separate the different workplace states or provinces with slashes.

22. Workplace X Coordinate (numeric, 2 digits)

Code the X coordinate of the serial killer's workplace as determined from the crime sites map. This number should usually lie in the range between 0 and 100. If this information is not known, leave blank.
23. Workplace Y Coordinate (numeric, 2 digits)

Code the Y coordinate of the serial killer’s workplace as determined from the crime sites map. This number should usually lie in the range between 0 and 100. If this information is not known, leave blank.

24. Scale (km/unit) (numeric, 4 digits)

Code the scale in kilometres per unit for the crime sites map. This number should have 3 significant digits, and lie in the range between 0.0100 and 01.00. If this information is not known, leave blank.

25. Data File (numeric, 3 digits)

Code the QuickBasic data file number.

26. Comments (alphanumeric, unlimited)

Code any other relevant or explanatory information. Preface comments concerning a particular question with the number of the question (e.g., 11. The serial killer does not seem to fit into any of the categories in the Holmes and De Burger typology.).
27. References (alphanumeric, unlimited)

List all the references used in filling out the coding forms. The references for the information coded in the associated serial murder victims forms (Form #2) and the serial murder locations forms (Form #3) should be listed here as well. Use APA style including chapter or page numbers (e.g., Smith, 1990, pp. 145-151, 165). Chapter or page numbers are not necessary if the reference is entirely devoted to the serial killer case being coded.

Form #2: Serial Murder Victims

This coding form is used for information about the victims of the serial killer. Each serial killer will be associated with multiple victims. All Form #2s should be attached to the associated Form #1. If the information does not fit into one of the listed categories code as 0 or 00 (Other) as appropriate, and explain in the comments section. If the information is unknown or not available, code as 9 or 99 (Unknown) as appropriate. Leave blank if the question is not applicable.
1. Sequential Number (numeric, 4 digits)

   Code the two-digit sequential number of the associated serial killer, followed by the two-digit sequential number of the serial murder victim.

2. Surname (alphanumeric, unlimited)

   Code the surname of the serial murder victim. If multiple victims have the same surname, code with a numeric extension (e.g., Jones 1, Jones 2, etc.).

3. Sex (circle relevant number)

   Code the sex of the serial murder victim.

4. Victim/Killer Relationship (circle relevant number)

   Code the relationship, at the time of encounter, between the serial murder victim and the killer. For example, if the killer and victim met in a bar, drank together for several hours, and then went to the killer’s home where the victim was subsequently murdered, the relationship is Stranger (the relationship at time of encounter) and not Casual Acquaintance (the relationship at the time of the murder).
5. Killer Selection (circle appropriate number)

Code as *Nonrandom/Patterned* if the victim was chosen because of any group categorizations, selection processes, or hunting tactics used by the serial killer (e.g., picking up prostitutes, taking in boarders, placing personal ads in newspapers, etc.). In other words, the victim must have been part of a certain group (e.g., child), expressed unique class characteristics (e.g., lived in a home close to a freeway ramp), or engaged in specific actions that were not part of the routine activities of the majority of society (e.g., hitchhiking). The locations of nonrandom or patterned victim selections by the serial killer are often dependent upon the target backcloth. Code as *Random/Nonpatterned* otherwise.

6. Victim Traits (circle relevant number)

Code as *Specific* if the serial killer selected the victim on the basis of specific individual (as opposed to class) traits (i.e., a particular appearance, action, response, verbiage, etc.). Code as *Nonspecific* otherwise.
7. Victim Activity (circle all relevant numbers)

   Code the type of activity that the victim was engaged in at the time of first encounter with the serial killer. If more than one type of activity was involved, circle all those that apply.

8. Killer Hunting Style (circle relevant number)

   Code the serial killer's hunting style using the hunting style typology developed in this dissertation.

9. Killer Approach (circle relevant number)

   Code the type of approach used by the serial killer during the first encounter with the victim.

10. Control Method (circle all relevant numbers)

    Code the method used by the serial killer to initially control the victim (i.e., during the attack). If more than one method was used, circle all those that apply. If the victim was not controlled but rather was immediately murdered in a blitz assault, code as Blitz Assault.
11. Murder Method (circle all relevant numbers)

Code the method used by the serial killer to murder the victim. If more than one method was used, circle all those that apply.

12. Crime Location Set (circle relevant number)

Code the applicable crime location set. For any given serial murder victim, 8 combinations of the 4 different crime locations or sites are possible, depending on which actions occurred in the same places (e.g., was the murder scene the same as the attack site?). In the following listed categories, $E$ refers to encounter site, $A$ refers to attack site, $M$ refers to murder scene, and $D$ refers to body dump site. An arrow between crime location types signifies movement between them (i.e., they occurred in different places), while the absence of an arrow between crime location types signifies a lack of movement between them (i.e., they occurred in the same place). If the locational relationship between the four different crime sites is not known, do not code any number, but rather write out, in the same format as the listed categories, the relationships between those crime sites that are known.
13. Attempt to Hide Body (circle relevant number)

Code if the victim's body appeared to have been displayed, dumped, or the degree to which it appeared to have been hidden. Code as *Dumped* if the serial killer moved and dumped the victim's body. Code as *Other Not Hidden* if the serial killer left the body where it lay after the completion of the attack or assault.

14. Linked (circle relevant number)

Code whether or not the crime was linked during the police investigation (but prior to the case resolution) to the other victims in the murder series.

15. Comments (alphanumeric, unlimited)

Code any other relevant or explanatory information. Preface comments concerning a particular question with the number of the question (e.g., *10. The victim was murdered by drowning, which is not one of the listed categories.*).
Form #3: Serial Murder Locations

This coding form is used for information about the locations associated with a serial murder victim. Each serial murder victim may be associated with multiple locations (up to 5), and each of these unique locations requires a Form #3. This is true whether any information is known about the location or not. Through the victim, each location is also associated with a serial killer. All Form #3s should be attached to the associated Form #2. If the information does not fit into one of the listed categories code as 0 or 00 (Other) as appropriate, and explain in the comments section. If the information is unknown or not available, code as 9 or 99 (Unknown) as appropriate. Leave blank if the question is not applicable.

1. Sequential Number (numeric, 5 digits)

   Code the two-digit sequential number of the relevant serial killer, followed by the two-digit sequential number of the relevant serial murder victim, followed by the one-digit sequential number of the serial murder location.

2. Location Type (circle all relevant numbers)

   Code the serial murder location type. If more than one location type is applicable (e.g., the body dump site was the same as the murder scene),
circle all the relevant numbers. *Witness Site* refers to those locations where
the serial killer was observed by witnesses.

3. **Location Address** (alphanumeric, unlimited)

Code the address for the serial murder location in the following order: (1) apartment number (if applicable); (2) street address; (3) street name; and (4) street type (e.g., #401-2343 Broad St.). If the exact address is not known, record the cross streets or the best available locational information.

4. **Location City** (alphanumeric, unlimited)

Code the city for the serial murder location.

5. **Location State** (alphanumeric, 2 letters)

Code the state or province for the serial murder location with the official U.S. Postal Service two-letter abbreviations (e.g., code Washington as WA, and British Columbia as BC). If the location is in the United Kingdom, code as *UK*. 

437
6. Location X Coordinate (numeric, 2 digits)

Code the X coordinate of the serial murder location as determined from the crime sites map. This number should usually lie in the range between 0 and 100. If this information is not known, leave blank.

7. Location Y Coordinate (numeric, 2 digits)

Code the Y coordinate of the serial murder location as determined from the crime sites map. This number should usually lie in the range between 0 and 100. If this information is not known, leave blank.

8. Location Known During Police Investigation (circle relevant number)

Code whether or not the location was known to the police prior to the apprehension of the serial killer.

9. Area Land Use (circle relevant number)

Code the area land use type by the predominant land use in the neighbourhood or area of the crime location.
10. Site Description (circle all relevant numbers)

Code the site type by the specific nature of the immediate location of the crime site. If more than one site type is applicable, circle all the relevant numbers. For example, if the site was a car situated in a parkade, code as both Vehicle and Parking Lot.

11. Site Classification (circle relevant number)

Code the appropriate site classification. Code as Private if the site was on privately-owned property, Semi-Public if the site was on privately-owned property that is open to the public (such as a place of business), and as Public if the site was on publicly-owned property. Code as Inside if the site was inside a house, building, or structure; otherwise code as Outside.

12. Date (numeric, 6 digits)

Code the date by year first, the month, then day (e.g., March 7, 1967 is coded as 67.03.07). The date is the date that the location was used by the serial killer. It may be necessary to estimate the date or to use a range of dates. If this information is not known, leave blank.
13. Time Arrived/Time Left/Total Time At Scene (numeric, 4 digits each)

Code the time in a 24 hour clock format (e.g., 9:36 p.m. is coded as 21:36).

“Time Arrived” is the time that the serial killer arrived at the location.

“Time Left” is the time that the serial killer left the location (if the killer left and returned, indicate so and record all the relevant times). “Total Time At Scene” is the difference between these two times, indicating the total time spent at the scene by the serial killer. It may be necessary to estimate the time or to use a range of times. In some cases, times may be approximate or rough (i.e., Evening, Very short time period, About one hour), and the information may have to be coded as alphanumeric. If this information is not known, leave blank.

14. Killer Travel Method (circle relevant number)

Code the method the serial killer used to travel to the location.

15. Victim or Killer Residence (circle relevant number)

Indicate if the location was also the residence of the victim, the serial killer, both, or neither.
16. Comments (alphanumeric, unlimited)

Code any other relevant or explanatory information. Preface comments concerning a particular question with the number of the question (e.g., 13.

*The serial killer reached the encounter site by bicycle, which is not one of the listed responses.*).
APPENDIX D

GEOGRAPHIC PROFILING REQUIREMENTS
Introduction

Geographic profiling is a new investigative support technique designed to provide assistance in cases of serial violent crime. The process, based on an analysis of the locations of a connected series of offences, the characteristics of the neighbourhoods in which they have occurred, and the psychological profile of the offender, is an effort to determine the most probable areas in which the offender resides or works. Geographic profiling is best understood as an information management strategy that can be used to prioritize suspects and addresses, and to help suggest new investigative tactics to complement traditional methods.

Applicability

Not every case may be geographically profiled. While a preliminary review is necessary to determine suitability, generally a profile may be developed when the following conditions have been met:
1. A series of crimes has occurred and they have been linked together with a reasonable degree of certainty (i.e., it is believed that they were most probably committed by the same offender);

2. There are at least 5 crimes in the series (although in special circumstances, it may be possible to provide a partial profile with a fewer number of cases); and

3. The investigation is of a serious enough nature to justify the time and effort required to produce the profile.

Requirements

The following is a standard list of geographic profiling information requirements. Any particular case may require additional details. The majority of the information will likely have already been collected during the course of the investigation, and the remainder is readily obtainable from most city or regional planning departments. The absence of some of the requirements should not be seen as a barrier or reason to delay the analysis as alternative sources of information may be available. In such cases, consult with the geographic profiler.
1. *Crime Data*

Case summaries for all the crimes believed to be part of the series, including any details regarding locations, directions, movements, and other spatial data. Information should include: crime type; modus operandi; weapon type; date; day of week; time; weather; and so forth.

2. *Geographic Data*

For all relevant sites (i.e., where victims last seen, first contact sites, crime sites, body and vehicle dump sites, property and evidence recovery sites, etc.):

(a) exact location (address and cross streets);

(b) location type (residential, commercial, industrial, including relevant buildings);

(c) neighbourhood demographics and general area description (census data including age and sex ratios, socio-economic character, overall crime rate, relevant specific area crime problems, and transiency levels);
(d) maps (city or region, arterial routes, bus routes, crime scenes, land use, zoning); and

(e) photos (crime scenes, general area, aerial).

3. Victimology

For all victims: sex; race; age; risk level assessment; residence; business; social activities; transportation methods; and travel routes.

4. Psychological/Criminal Profile

The psychological profile plays a very important role in determining the probable life and mind set of the offender and consequently is of great value when constructing a geographic profile, particularly in those cases where there is a minimum amount of spatial information (i.e., only a few relevant crime locations).
5. Suspect Data

If known: sex; age; race; criminal record; previous police contacts; psychological or psychiatric history; addresses of present and past residences, schools, and employment; social activities; locations of family members, friends, and other significant people; transportation methods; and travel routes.

Further details on the applicability, requirements, and preparation of a geographic profile can be obtained from Constable D. Kim Rossmo, Crime Prevention Unit, Vancouver Police Department, 312 Main Street, Vancouver, British Columbia, Canada, V6A 2T2 (ph. (604) 665-2285). Requests for geographic profiling should be directed to Chief Constable R. J. (Ray) Canuel of the Vancouver Police Department (fax (604) 665-5078).


Brooks, P. R. (1984, November). VICAP. Lecture presented at Washington Criminal Justice Training Center seminar, Seattle, WA.


Cleary, S., & Luxenburg, J. (1994, November). Classifying the serial killer according to personality type and victim selection pattern. Paper presented at the meeting of the American Society of Criminology, Miami, FL.


  *Trooper Magazine*, (May/June), 8-9.


  Unpublished manuscript, Police Research Group, Home Office Police Department, London.

  Police Research Group, Home Office Police Department, London.


Daly, M., & Wilson, M. (1994). Evolutionary psychology of male violence. In J. 


  Unpublished manuscript, Canadian Police Association, Ottawa.

  Toronto: Viking.


Female serial killer trial opens. (1992, January 16). *The Vancouver Sun*.


Gabrish and Balcerzak v. Board of Fire and Police Commissioners for the City of Milwaukee (Milwaukee County Cir. Court, Wisc., April 27, 1994).


James, C. A. M. (1992). Peter William Sutcliffe: 'The Yorkshire Ripper'. Unpublished manuscript, Simon Fraser University, School of Criminology, Burnaby, BC.


Keeney, B. T., & Heide, K. M. (1994b, November). *Serial murder: Refining the definition to capture the involvement of men and women*. Paper presented at the meeting of the American Society of Criminology, Miami, FL.


Shedding light on Russian justice. (1992, October 15). USA Today, p. 2A.


Spore, C. V. (1994, March). The antisocial personality disorder as found in serial murderers. Paper presented at the meeting of the Academy of Criminal Justice Sciences, Chicago, IL.


549


