Geographic Profiling of Serial Murderer, Gary Ridgway, to Assist Law Enforcement in the Apprehension of Future Serial Murderers

Rachel Neldner
Department of Resource Analysis, Saint Mary’s University of Minnesota, Winona, MN 55987

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Abstract

This research focuses on the geographic profiling of a serial murderer for the purpose of assisting law enforcement in the apprehension of future serial murderers. Serial murderers have distinctive characteristics and hunting styles which distinguishes them from other offenders. This case study focuses on the study of the Green River Killer, Gary Ridgway. Ridgway eluded law enforcement capture for nearly twenty years. He was eventually captured through DNA linked from several crime victims. This research examines spatial description of incident data using the following functions: (1) Mean Center; (2) Center of Minimum Distance; and (3) Standard Deviational Ellipse. Also, this research examines incident data using spatial modeling – the Journey to Crime (JTC) estimate/probability map. It is hoped this analysis will help law enforcement to narrow search areas for future offenders. Geographic profiling results can impact an investigation by suspect prioritization, patrol saturation, neighborhood canvasses, police information systems data contained within police database, and DNA searches.

Introduction

According to Rossmo (2000), knowledge gained through research and experience of how and where criminal predators hunt for victims both have practical and theoretical implications. Investigative efforts can produce large numbers of potential suspects, often totaling into the hundreds and even thousands, which cause problems with information overload (Rossmo, 1997). Along with information overload, high costs associated with any extensive long-term investigation justifies the need for research in the area of geographic profiling (Rossmo). According to Paulsen and Robinson (2009), research seeks to develop simple spatial diagnostics which can be used to assist in deciding which cases are capable of being profiled as well as improving profile accuracy.

Serial Murder

Brooks, Devine, Green, Hart, and Moore (1987), define serial murder as a series of two or more murders, committed as separate events, usually, but not always by one offender acting alone (Rossmo, 2000). The crimes may occur over a period of time ranging from hours to years. The Federal Bureau of Investigation (2008) defines serial murder as “the unlawful killing of two or more victims by the same offender(s), in separate events” with a time period between murders.

Serial Murderers’ Hunting Typology

Predatory criminals employ various hunting styles in their effort to seek out and attack victims. These, in turn, affect the spatial distribution of the offender’s crime site, suggesting that any effort to predict offender residence from crime locations must consider hunting styles (Rossmo, 2000). While murder can potentially involve several different types of crime locations, experience has shown the victim encounter and body dump sites are most important in terms of an investigation-oriented geographic analysis (Rossmo).

According to Rossmo (2000), the serial murderers hunting process can be broken down into two components: the search for a suitable victim and the method of attack. The victim selection method is categorized as hunter, poacher, troller, and trapper. Crimes of a hunter are generally confined to the offender’s city of residence and the offender sets out from their residence to search for victims in the area within their awareness space.

The victim attack method is defined as raptor, stalker, and ambusher (Rossmo, 2000). The raptor is characterized by attacking almost immediately upon encountering their victim. Whereas the stalker follows, watches their victim and waits for an opportune moment to attack. The attack, murder, and victim release sites are thus strongly influences by the victim activity space. Finally, the attack of the ambusher is committed someplace where the offender has a great deal of control, such as their residence or workplace (Rossmo).

**Murder and Distance**

As seen in Keppel and Weis (1993), they found, the more information known regarding times and locations of the crimes, the greater the likelihood the case will be solved (Rossmo, 2000). Crime locations provide evidence and witnesses; time of offender allows suspect alibis to be verified or refuted. Together, they permit investigators to establish if the victim and a suspect were in the same area at the same time (Rossmo). Keppel and Weis’s study broke murder down into five potential different locations: (1) victim last seen site; (2) initial contact site; (3) initial assault site; (4) murder site; and (5) body recovery site (1993). The initial contact site and body recovery site are the most important in determining where the offender residences occurs (Beauregard, Proulx, and Rossmo, 2005).

Additional elements which are important to geographic profiling are crime location, types, target backcloth, and offender hunting styles. Other factors to consider during the investigation are the location of arterial roads and highways, presence of bus stops and rapid transit stations, physical and psychological boundaries, zoning and land use, neighborhood demographics, routine activities of victims and displacement (Rossmo, 1997).

**Movement and Distance**

As seen in Stea (1969), an individual’s perception of distance is influences by several factors, including (1) relative attractiveness of origins and destinations; (2) number and types of barriers separating points; (3) familiarity with routes; (4) actual physical distance; and (5) attractiveness of routes (Rossmo, 2000).

**Mental Maps**

Mental maps are cognitive images of
familiar areas such as neighborhoods or cities formed from a distillation of the particular transactions a person has with his or her surroundings (Rossmo, 2000). Mental maps have an influence on crime site selection because a target cannot be victimized unless an offender is first aware of it (Rossmo).

**Awareness Spaces**

Awareness spaces are defined as all the locations about which a person has knowledge above a minimum level even without visiting some of them (Rossmo, 2000).

**Activity Spaces**

Activity spaces are defined as 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 (Rossmo, 2000).

**Anchor Points**

As seen in Coucelis, Golledge, Gale and Tobler; 1987, activity space are anchor points or bases, the most important places in one’s spatial life (Rossmo, 2000). The main anchor point for the vast majority of people it is their residence, but other bases may exist such as a worksite or friend’s home (Rossmo).

According to Canter (1994), offenders operate within the confines of their experiences, habits, awareness, and knowledge (Rossmo, 2000). Criminals select targets or victims from their awareness zones, and access them in terms of criteria of suitability (gain or profit) and risk (probability of being observed or apprehended) (Ainsworth, 2001).

According to the FBI (2008), most serial murders have very defined geographic areas of operation. They conduct their killings within comfort zones which are often defined by an anchor point. Serial murderers will, at times, spiral their activities outside of their comfort zone, when their confidence has grown through experience or to avoid detention. Very few serial murderers travel interstate to kill (FBI).

**Case Studies**

Lundrigan and Canter (2001), examined the geographic distribution of the sites at which 126 US and 29 UK serial murderers disposed of their victim’s bodies. They found the majority of the murderers operate within area that bore a strong relationship to their home. Also, it was found that rational choice and routine activity models of criminal behavior could explain the spatial choices of serial murderers (Lundrigan and Canter). They reported the median and average residence-to-crime distances for American serial murderers were 15 km (9.315 miles) and 40 km (24.82 miles), respectively whereas the median and average residence-to-crime distances for UK serial murderers were 9 km (5.589 miles) and 18 km (11.178 miles) (Lundrigan and Canter).

In a study conducted by Snook, Cullen, Mokrus, and Harbort (2005), 53 German serial murderers were examined for factors that influence crime location choices. Results showed 63% of the murderers lived within 10 km (6.21 miles) of their crime locations (Snook et al.). Also, 78% of the victims were found within 20 km (12.42 miles) of the murderer’s residence and 84% were found within 30 km (18.63 miles) (Snook et al.). Residence-to-crime distance was negatively correlated with murderer age.
and positively correlated with murderer IQ score. Results also showed the mode of transportation used by murderers had an effect on their spatial decisions (Snook et al.).

Godwin and Canter (1997) showed victim encounter locations were, on average 2 km (1.242 miles) from the offender’s residence and body recovery locations were 23 km (14.283 miles) from the offender’s residence.

By comparison, Rossmo (2000) found American serial murderers generally encountered targets at an average distance of approximately 22 km (13.662 miles) and left their victims’ bodies on average of approximately 34 km (21.114 miles) from their home location. A breakdown of Rossmo’s (2000) results indicated residence-to-crime distances were shorter than 20 km (12.42miles) for 46% of his sample.

The results show the residence-to-crime distance distribution follows a decay pattern, whereby the likelihood of disposing of a body decreases as the distance from the murderer’s residence increases, and furthermore the median and average distance from the murderer’s residence to the body recovery locations are roughly 8 km (4.968 miles) and 30 km (18.63miles) (Snook et al., 2005).

Analysis Process

Geographic Profiling

Geographic profiling is an investigative methodology which uses the locations of a connected series of crimes to determine the most probable area of offender residence (Rossmo, 2000). According to Rossmo, geographic profiling does not solve cases, but rather provides a method for managing the large volume of information typically generated in major crime investigations. Also, geographic profiling is one component of the criminal investigative behavioral science repertoire, a triad that also includes linkage analysis and psychological profiling (Rossmo, 1997).

The location of a crime site can be seen as an important clue, one which can provide valuable information to police investigators (Rossmo). Geographic profiling focuses on the probable spatial behavior of the offender within the context of the locations of, and the spatial relationships between, the various crime sites (Rossmo).

According to Rossmo (1997), geographic profiling has both quantitative (objective) and qualitative (subjective) components. The objective component uses a series of scientific geographic techniques and quantitative measures to analyze and interpret the point pattern created from the locations of the target sites (Rossmo). The subjective component of geographic profiling is based primarily on a reconstruction and interpretation of the offender’s mental map (Rossmo).

Additional geographic profiling is only applicable to crime series in which a relatively complete series of crimes have been linked to an offender, the offender has not moved during the crime series, the target backdrop is relatively uniform, and the offender is a marauder or local criminal (Beauregard et al., 2005). In general, a case may be geographically profiled when a series of crimes has occurred that are linked together with reasonable degree of certainty (Beauregard et al.).

In conclusion, geographic profiling attempts to use the crime locations in order to predict the most probable area where the offender resides or works (Beauregard et al.). Geographic profiling is a framework for understanding how an
offender traverses an area in searching for victims or targets; this involves understanding the social environment of an area, the way the offender understands this environment as well as the offender’s motives (Levine and Associates, 2002). Levine’s CrimeStat Spatial Modeling uses geographic profiling and journey to crime estimation which follows a much simpler logic involving the distance dimension of the spatial patterning of a criminal (Levine and Associates). It is a strictly statistical approach to estimating the residential whereabouts of an offender compared to understanding the dynamics of serial offenders (Levine and Associates).

Journey to Crime

The journey to crime routine is a diagnostic designed to aid law enforcement in their investigations of serial offenders (Levine and Associates, 2002). The aim is to estimate the likelihood that a serial offender lives at any particular location (Levine and Associates). Using the location of incidents committed by the serial offender, CrimeStat III makes a statistical probability at where the offender is liable to live based on the similarity in travel patterns to a known sample of serial offenders for the same type of crime (Levine and Associates).

The JTC routine builds on the Rossmo (1993a; 1993b; 1995) framework, but extends it modeling capability by the following: 1) a grid is overlaid on top of the study area; 2) the routine calculates the distance between each incident location committed by a serial offender and each cell defined by the centroid of the cell; 3) a distance decay function is applied to each grid cell-incident pair and sums the values over all incidents; 4) the resultant of the distance decay function for each grid cell-incident pair are summed over all incidents to produce a likelihood or density estimate or each grid cell; 5) the program outputs two results: a) the grid cell which has the peak likelihood estimate; and b) the likelihood estimate for every cell (Levine and Associates, 2002).

Purpose

This research intends to help law enforcement in the apprehension of future serial murderers by providing insight into the spatial activities of a serial murderer, Gary Ridgway through the use of geographic profiling and journey to crime routine.

Data

Most data needed for this research was collected from the Superior Court of Washington for King County, the Prosecutor’s Summary of the Evidence against Gary Leon Ridgway, newspapers articles, and book resources.

Data Collection

Victim Last Seen/Recovery Locations

Primary data was obtained from the Superior Court of Washington for King County, the Prosecutor’s Summary of the Evidence against Gary Leon Ridgway. The purpose of this document is to provide a full account of the murders described as the Green River killings. This is as close as is known to the truth about the Green River homicides. This document was reviewed to obtain dates, times, locations of victims last seen and locations of victims’ recovery, along with suspect locations such as employment and residence.
Ridgway’s primary residence between 1981 and 1985 was located at 21859 32\textsuperscript{nd} Place South in King County Washington (Figure 1). Ridgway was employed at Kenworth located on East Marginal Way South, just a few miles north of the stretch of Pacific Highway South where he later encounter many of his victims. Both of these locations were used in this case study as Ridgway’s primary anchor points (Figure 1).

Google map was used to determine the X and Y coordinates (in degrees, minutes, seconds) of the victim’s last seen, victim’s recovery locations and Ridgway’s anchor points. The X and Y coordinates were converted to decimal degrees and plotted with ArcGIS software.

Once in ArcGIS, the data were projected into NAD\_1983\_UTM\_Zone\_10N. New X and Y attribute fields were added to the shapefiles and geometry is calculated in meters for import into CrimeStat’s III for statistical analysis.

The Nearest Neighbor test for clustering was performed on the entire victim encounter sites and the entire body recovery sites data sets using the ArcGIS Average Nearest Neighbor tool. The test on the entire victim encounter sites revealed, given the z-score of -5.02, there is a less than 1% likelihood this clustered pattern could be the result of random chance (Figure 2). The test on the entire body recovery sites produced a z-score of 7.00 indicating there is a less than 1% likelihood this clustering pattern could be the result of random chance (Figure 3).

Data layers used in this research were the following: 1) Entire Victim Encounter Sites; 2) 1982 Victim Encounter Sites; 3) 1982 to 1983 Victim Encounter Sites; 4) Entire Body Recovery Sites; 5) 1982 Body Recovery Sites; 6) 1982 to 1983 Body Recovery Sites; and 7) 1982 to 1984 Body Recovery Sites.

Additional information was also needed for analysis for the data layers. A minimum bounding rectangle (MBR), reference area was drawn around all the points to determine the lower-left corner x,
y coordinates, the upper right corner x, y coordinates, and the total area in square miles (Figure 4). Additionally, a MBR polygon is created for each data layer. This polygon was used to clip the roadways in the MBR area. The total length of street network was determined in miles by using the statistics sum in the attribute table.

Figure 2. Average nearest neighbor summary for the entire victim encounter sites.

Figure 3. Average nearest neighbor summary for the entire body recovery sites.

Figure 4. Minimum Bounding Rectangle encompasses both study areas, entire victim encounter area (red rectangle) and entire body recovery area (black rectangle).

Each data layer is imported into CrimeStat III separately for statistical analysis and spatial modeling. CrimeStat III requires a primary file (shapefile), reference file (MBR information) and measurement parameters (MBR information) to conduct statistical analysis called spatial distribution and spatial modeling called journey to crime. This study used distance measurements in indirect (Manhattan) distance. Indirect distance approximate actual travel pattern for a city where streets are arranged in grid pattern (Levine and Associates, 2002).

The Journey to Crime analysis uses normal distribution with preset values of 4.2 mean distance, 29.5 coefficient, 4.6 standard deviation and unit in miles.

The results are saved as shapefiles and text files to be imported in ArcGIS for visual analysis of the data for this study.

Supporting Data: Base Map Imagery
ESRI base maps were used in the final analysis for visual reference. This study used ESRI National Geographic World Map for the base imagery.

Methods

Spatial Distribution

The most basic type of descriptors for the spatial distribution of crime incidents are centrographic statistics, which include the following: 1) mean center; 2) median center; 3) center of minimum distance; 4) standard deviation of x and y coordinates; 5) standard distance deviation; and 6) standard deviational ellipse (Levine and Associates, 2002). This research examined the mean center, center of minimum distance and standard deviational ellipse of the victims’ encounter sites and victims’ body recovery sites.

Mean Center (MC)

The simplest descriptor of a distribution is the mean center, sometimes called a center of gravity (Levine and Associates, 2002). It identifies the mean center point of a group of points (Levine and Associates). The mean center can be thought of as a point where both the sum of all differences between the mean X coordinate and all other X coordinates is zero and the sum of all differences between the mean y coordinate and all other Y coordinates is zero (Levine and Associates). The offender’s anchor point is often very near the mean center (Paynich and Hill, 2010).

Center of Minimum Distance (Mcmd)

The center of minimum distance is a unique statistic which defines the point at which the sum of the distance to all other points is the smallest (Levine and Associates, 2002). CMD of crimes committed by a single serial offender will usually be the best single predictor of where the offender lives (Levine and Associates). The CMD is another indicator of the offender’s anchor point (Paynich and Hill, 2010). The mean center or center of minimum distance also has a high accuracy for revealing the offender’s home base where a marauder offender is involved (Paynich and Hill).

Standard Deviational Ellipse (Sde)

The standard deviational ellipse defines both the dispersion and the direction of the dispersion (Levine and Associates, 2002). Sde creates an ellipse representing one standard deviation around the mean center for a group of points (Levine and Associates). Sde helps identify concentration of incidents in a long-term trend or problem (Levine and Associates).

Probability Map

Journey to Crime Estimation (JTC)

The Journey to Crime routine is a distance-based method which makes estimates about the likely residential location of a serial offender (Levine and Associates, 2002).

Probability Distance Functions

A normal distribution assumes the peak likelihood is at some optimal distance from the offender’s home base (Levine and Associates, 2002). The function rises to distance and then declines. The rate of increase prior to the optimal distance and the rate of decrease from the distance are symmetrical in both directions (Levine and Associates).
Results

Entire Data Set for Victim Encounter Sites

Spatial distribution analysis was conducted on the 41 victim encounter locations of the entire data set (Figure 5).

During interviews with law enforcement, Gary Ridgway explained his general methods of finding and killing his victims. In virtually all murders he committed, Ridgway claimed, he used the same techniques for hunting, killing, and hiding the bodies (Maleng, 2001).

Ridgway devoted considerable time and effort to finding appropriate victims. He would spend hours before work and after, driving through areas of prostitution. Ridgway referred to these efforts as “patrolling.” Among the areas Ridgway “patrolled” regularly were: (1) the “Riverton” area – aka the Tukwila area along Pacific Highway South, according to Ridgway this is the area he found most of his victims; (2) the Kent-Des Moines area of PHS; (3) Rainier Valley; (4) Seattle’s International District; (5) Downtown Seattle; (6) North Seattle along Aurora Ave; and (7) PHS south of Federal Way between his house at 218th and South 188th, he estimated picking up and killing around 15 women on this stretch of the highway (Maleng, 2001).

This analysis revealed the victim encounter locations were, on average, 6.59 miles from Gary Ridgway’s residence and 1.52 miles from his place of employment. It was found the center of minimum distance for the victim encounter location were, on average, 4.71 miles from his residence and 3.47 miles from his place of employment (Figure 6).

Based on the Journey to Crime probability map, Gary Ridgway’s place of employment falls within the highest
probability area and his residence falls within the second highest probability area, suggesting his primary anchor point for hunting his victim’s was from his place of employment (Figure 7).

![Figure 7. JTC probability map, the offender’s place of employment (yellow triangle) falls within the highest probability area.](image1)

**1982 Data Set for Victim Encounter Sites**

Spatial distribution analysis was conducted on 13 victim encounter locations for the year 1982 (Figure 8).

This analysis revealed victim encounter locations were, on average, 4.74 miles from Gary Ridgway’s residence and 3.56 miles from his place of employment. The center of minimum distance for the victim encounter location were, on average, 3.45 miles from his residence and 4.66 miles from his place of employment (Figure 9).

Ridgway claimed he only hunted for prostitutes because they were frequently on the move which made it more difficult for law enforcement to determine where and when they had been killed (Maleng, 2001).

![Figure 8. Locations of the victim’s last known whereabouts (red dots).](image2)

Ridgway was correct in his assessment, law enforcement were often delayed in their investigation because no missing persons report was filed and even when a disappearance was reported it was difficult for investigators to pin down where the victim has last been seen and to complicate matters, numerous alleged sightings of the missing victims were reported long after they had been killed (Maleng).

Ridgway operated within the confines of his experiences, habits, awareness, and knowledge. He selected victims from areas which he was familiar with and he was extremely cautious when approaching his victims to elude detection from witnesses. Ridgway explained to law enforcement, he rarely picked up victims where they were working. He would lure them away from sight from others before picking them up (Maleng, 2001).
Figure 9. Example of mean center and center of minimum distance for the victim encounter locations. The mean center (blue star) was closest to the offender’s place of employment (yellow triangle). The center of minimum distance (purple star) was closest to the offender’s residence (green triangle).

Based on the Journey to Crime probability map, Gary Ridgway’s residence and place of employment fall within the highest probability area, suggesting the offender anchor points for hunting his victims were from both locations during this time period (Figure 10).

1983 Data Set for Victim Encounter Sites

Spatial distribution analysis was conducted on the 38 victim encounter locations for the years 1982 to 1983 (Figure 11). During this period of time, the number of reported missing women increased from 13 in the year 1982 to 38 in the year 1983. The community had a sexual predator in their area, which was preying on young prostitutes along Pacific Highway South.

This analysis revealed the victim encounter locations were, on average, 6.80 miles from Gary Ridgway’s residence and 1.31 miles from his place of employment. Also, the center of minimum distance for the victim encounter location were, on average, 4.73 miles from his residence and 3.44 miles from his place of employment (Figure 12).

Based on the Journey to Crime probability map, Gary Ridgway’s place of employment falls within the highest probability area and his residence falls within the second highest probability area. This suggests his primary anchor point for hunting his victims continued to be his place of employment (Figure 13).

Ridgway admitted during interviews with law enforcement, he spent numerous hours searching for his victims before and after work. During this time period, he slept only a couple of hours a night, and devoted the rest of his free time...
to hunting for victims, killing them, and disposing of their bodies (Maleng, 2001).

Figure 11. Locations of victim’s last known whereabouts (red dots).

Figure 12. Example of mean center and center of minimum distance for the victim encounter sites. The mean center (blue star) and center of minimum distance (purple star) were closest to the offender’s place of employment (yellow triangle).

Figure 13. JTC probability map, the offender’s place of employment (yellow triangle) was located in the highest probability area and the offender’s residence (green triangle) was located in the second highest probability area.

**Entire Data Set for Body Recovery Sites**

Gray Ridgway clustered body disposal sites to make it easier to determine whether or not bodies were discovered, and therefore, to avoid those sites. Also, he clustered the sites so he could remember where he had placed the bodies. The following are the area in which Ridgway had disposed of the bodies. The first location is the Green River area; he used this location to dispose of the first five victims (Figure 14).

The second body disposal site was located in the Star Lake Area. Ridgway disposed of six victims in this location (Figure 15). The third body disposal site was located in the South Airport Area. Ridgway disposed of four victims in this location (Figure 16).
Figure 14. Green River Victim Area. Victims located at this area included Wendy Coffield, Debra Bonner, Marcia Chapman, Cynthia Hinds and Opal Mills.

Figure 15. Star Lake Area. Victims located at this area included Terry Milligans, Alma Smith, Delores Williams, Gail Mathews, Sandra Gabbert, and Carrie Rois.

The fourth body disposal site was located in the North Airport Area. Ridgway disposed of three victims in this location (Figure 17). The fifth body disposal site was located in the Mountain View Cemetery Area. Ridgway disposed of three victims in this location (Figure 18).

Figure 16. South Airport Area. Victims located at this area included Mary Meehan, Andrea Childers, Constance Naon, and Kelly Ware.

The sixth body disposal site was located in the Highway 410 Area. Ridgway disposed of six victims in this location (Figure 19). The seventh body disposal site was located in the Interstate 90 and Highway 18 Area. Ridgway disposed of three victims in this location (Figure 20). The eighth body disposal site was located in the Interstate 90 off of Exit 38. Ridgway disposed of three victims in this location (Figure 21). The last body disposal site was located in the Highway 18 Area. Ridgway disposed of two victims in this location (Figure 22). Ridgway disposed of bodies in other locations but these areas were his primary disposal sites.
Figure 17. North Airport Area. Victims located at this area included Shawnda Summers, Jane Doe B10, and Cheryl Wims.

Figure 18. Mountain View Cemetery. Victims located at this area included Kimi-Kai Pitsor, Jane Doe B16, and Jane Doe B17.

Figure 19. Highway 410. Victims located at this area included Martha Authorlee, Debbie Abernathy, Mary Bello, Pammy Avent, Roberta Hayes and Marta Reeves.

Figure 20. Interstate 90 and Highway 18. Victims located at this area included Tina Thompson, April Buttram, and Maureen Feeney.
Ridgway claimed to have killed over sixty women between 1982 and 1998 (Maleng, 2001).

This analysis revealed the body recovery locations were, on average, 7.89 miles from Gary Ridgway’s residence and 13.28 miles from his place of employment. The center of minimum distance for the body recovery locations were, on average, 3.49 miles from his residence and 11.15 miles from his place of employment (Figure 24).

Based on the Journey to Crime probability map, Gary Ridgway’s residence falls within the highest probability area, suggesting the offender anchor point was his residence or an area close to his residence to commit his killings (Figure 25).

Spatial distribution analysis was conducted on the 44 body recovery locations of the entire data set (Figure 23). During interviews with law enforcement,
and quickly pull the body out of the vehicle and dump it just off the roadway. Then, he would drive up the road and park just far enough away so if the vehicle was approached by law enforcement, the body would not be discovered. He would walk back through the woods to the body and it drag the victim farther from the road (Maleng, 2001). Ridgway favored dumpsites which were remote, heavily wooded, and steep. His decision to dump a body at one or another location was random, but later he explained he did not want to frequent one site consecutively for fear he would be seen and associated with it (Maleng). Ridgway clustered sites to make it easier to determine whether the bodies had been discovered, and therefore, to avoid those sites. He clustered the sites also to remember where the sites were located (Maleng).

Figure 24. Example of mean center and center of minimum distance for the body recovery sites. The mean center (blue star) and center of minimum distance (purple star) were closest to the offender’s residence (green triangle).

Figure 25. JTC probability map, the offender’s residence (green triangle) falls within the highest probability area.

1982 Data Set for Body Recovery Sites

Spatial distribution analysis was conducted on the 1982 data set of 6 body recovery locations (Figure 26).

The first several victims are most telling of the offender’s signature, behaviors, and anchor point. Overtime, the offender will travel farther to dispose of the bodies to distance themselves from the crime scene to elude capture. Also, overtime, the offender will become better at what they are doing which makes it hard for law enforcement to catch them.

On July 8, 1982, Wendy Coffield left her foster home in Tacoma, Washington and was never seen alive again. She was known to work as a street prostitute along PHS. On July 15, 1982, Coffield’s body was discovered along the Peck Bridge in Kent, floating in the Green River.

On July 25, 1982, Debra Bonner was last seen alive when she left a motel
on PHS to “catch some dates.” Two and a half weeks later, on August 12, 1982, Bonner’s body was discovered in the Green River.

In August of 1982, Marcia Chapman was living with her three children in an apartment near PHS. She was involved in prostitution. On August 1, 1982, Chapman left her apartment and was not seen again. On August 11, 1982, Cynthia Hinds was out on PHS working as a prostitute. She was never seen alive again. On August 12, 1982, Opal Mills placed a call to her parent’s from Angle Lake State Park, just off PHS. She was never heard from again.

On August 15, 1982, the bodies of Marcia Chapman and Cynthia Hinds were spotted in the water, approximately 600 years from where Debra Bonner’s body had been found a few days earlier. Opal Mills’ body was found on the banks of the river a short distance away. All three women had been strangled.

In July of 1982, Gisele Lovvorn worked as a prostitute on PHS. On July 17, 1982, Lovvorn left her apartment, saying she planned to turn several tricks on PHS and would return later in the day. She was never seen again. On September 25, 1982, Lovvorn’s remains were found near an apple tree in a wooded area near South 200th Street and 18th Ave South in King County (Maleng, 2001).

This analysis revealed body recovery locations were, on average, 1.24 miles from Gary Ridgway’s residence and 9.19 miles from his place of employment. The center of minimum distance for the body recovery locations were, on average, 1.69 miles from his residence and 9.60 miles from his place of employment (Figure 27).

Based on the Journey to crime probability map, Gary Ridgway’s
residence falls within the second highest probability area, continuing to suggest the offender’s anchor point was his residence or an area close it (Figure 28). The offender admitted during investigative interviews, he would use his residence and wooded areas along his routine to kill his victims.

![Figure 28. JTC probability map, the offender’s residence (green triangle) falls within the second highest probability area.](image)

**1983 Data Set for Body Recovery Sites**

Spatial distribution analysis was conducted on the 1982 to 1983 data set of 14 body recovery locations (Figure 29).

This analysis revealed body recovery locations were, on average, 0.79 miles from Gary Ridgway’s residence and 7.62 miles from his place of employment. The center of minimum distance for the body recovery locations were, on average, 1.68 miles from his residence and 9.59 miles from his place of employment (Figure 30).

![Figure 29. Locations of body recovery sites of 1982-1983 (purple dots).](image)

![Figure 30. Example of mean center and center of minimum distance for the body recovery sites. The mean center (blue star) and center of minimum distance (purple star) were closest to the offender’s residence (green triangle).](image)
Based on the Journey to crime probability map, Gary Ridgway’s residence falls within the highest probability area, suggesting his anchor point was his residence or an area nearby as his primary killing location (Figure 31).

Figure 31. JTC probability map, the offender’s residence (green triangle) falls within the highest probability area.

**1984 Data Set for the Body Recovery Sites**

Spatial distribution analysis was conducted on the 1982 to 1984 data set of 27 body recovery locations (Figure 32).

This analysis revealed the body recovery locations were, on average, 6.17 miles from Gary Ridgway’s residence and 11.68 miles from his place of employment. The center of minimum distance for the body recovery locations were, on average, 2.20 miles from his residence and 10.03 miles from his place of employment (Figure 33).

Based on the Journey to crime probability map, Gary Ridgway’s

Figure 32. Locations of body recovery sites in 1982 to 1983 (purple dots).

Figure 33. Example of mean center and center of minimum distance for the body recovery sites. The mean center (blue star) and center of minimum distance (purple star) were closest to the offender’s residence (green triangle).
residence falls within the highest probability area which suggested his anchor point continued over time to be his residence or an area nearby to commit his killings (Figure 34).

![Figure 34. JTC probability map, the offender’s residence (green triangle) falls within the highest probability area.](image)

**Sources of Error**

**Geographic Profiling**

Additional geographic profiling is only applicable to crime series in which a relatively complete series of crimes have been linked to an offender, the offender has not moved during the crime series, the target backcloth is relatively uniform, and the offender is a marauder or local criminal (Beauregard, Proulx, and Rossmo, 2005). In general, a case may be geographically profiled when a series of crimes have occurred that are linked together with reasonable degree of certainty (Beauregard et al., 2005).

**Geographic Profile Sample Size**

As sample size decreases, the likelihood of modeling error increases and the model becomes unreliable (Smith and Bruce, 2008). According to Rossmo, there must be a least five crime sites in the series or five crime locations for the profile to be reliable (2000).

**Calibrating Geographic Profile and Journey to Crime**

CrimeStat III spatial modeling requires user input when calibrating the journey to crime analysis. The user is able to select from the following five mathematical formulas: (1) Linear; (2) Negative Exponential; (3) Normal; (4) Lognormal; and (5) Truncated Negative Exponential. Each mathematical formula will interpret data in a different way which could skew the final results. The data and type of offense needs to be evaluated prior to selecting which mathematical formula should be used for the analysis.

**Future Directions**

Geographic profiling alone only gives law enforcement a location to prioritize their search efforts. This tool can be enhanced with the use of investigative databases such as arrest records, crime reports, jail booking information, probation/parole information, sex offender registration databases. Using these various sources can help to identify your potential suspect, not just a location to start your investigation. This data layers will help prioritize suspect based on geography and prior criminal activities.

The results of geographic profiling can assist law enforcement prioritizing areas for future patrol by nearing their
search grid and house to house canvasses for additional information.

**Conclusion**

The offender, Gary Ridgway had very distinctive hunting, killing and disposal patterns. His hunting methods were in a linear pattern from his work to his residence and small clusters of areas north and south of Pacific Highway South. The activity space of his victim of choice had extreme influence on his hunting patterns and methods. It was easy for Gary Ridgway to blend into the backcloth of the environment and remain under the radar for years. Gary Ridgway used his residence and wooded areas to commit his killings, which gave him great deal of control over his killing methods and patterns. Gary Ridgway used clustering of disposal sites to determine whether or not the bodies had been discovered, and therefore, to avoid those sites. Overtime, Ridgway disposed of the bodies farther and farther away from his residence, which according to research, is intuitive of serial murderers to remain undetected.

This study was able to identify the offender’s anchor points by using spatial statistics and spatial modeling. The results provided visual confirmation of the offender’s hunting patterns and anchor points. Geographic profiling is a tool which can help in the apprehension of serial murders by prioritizing target areas to focus their investigative efforts.

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**References**


