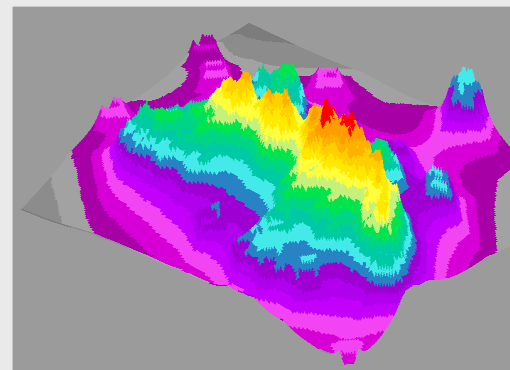
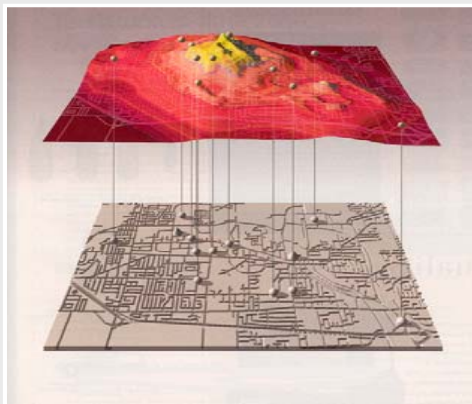


# Introduction to Geographic Profiling for Crime Analysis



Environmental Criminology Research Inc.  
Vancouver, B.C., Canada

# Geographic Profiling

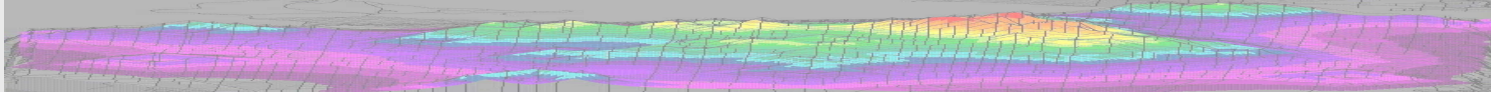
This tutorial will introduce you to the basics of geographic profiling, including what it is and how it's used for crime analysis. It mentions many of the issues you might encounter in practice, and gives examples of what can be done about them.

It does not explain the research behind geographic profiling or the mathematics of how it works in any depth. It gives only a sampling of the pitfalls that can be encountered and the possible solutions available. The section on Training explains how you can obtain professional training that covers these topics in more detail.

# Geographic Profiling Theory

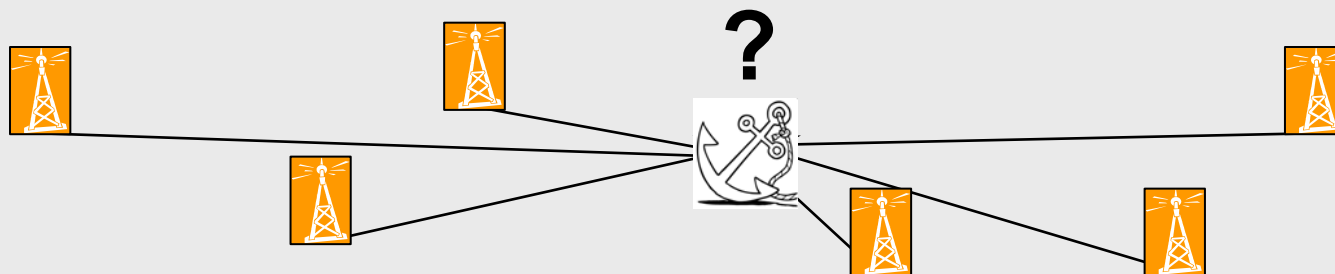
- Geographic profiling is based on research in the field of Environmental Criminology, i.e., how the environment around us influences crime.
- Environmental Criminology in general and geographic profiling in particular focuses more on the “where?” than the “why?” of crime. It doesn’t depend on what motivates the offender. It is based on the practical details of how and where the offender finds their targets.

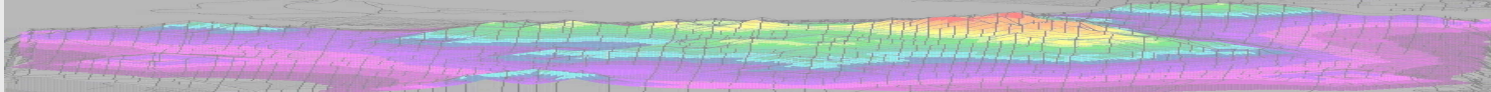




# Geographic Profiling – Definition

Geographic Profiling is a spatial analysis technique that analyzes the known locations of incidents which are geographically connected to an unknown base of operations to determine where that base is most likely located.





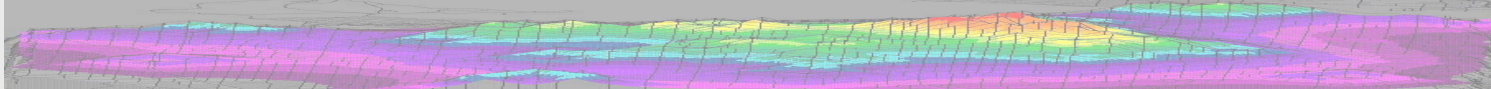
# Geographic Profiling for Crime Analysis

Geographic Profiling was developed to focus serial crime investigations on the home base of the offender by analyzing the geographic pattern of a linked series of crimes.



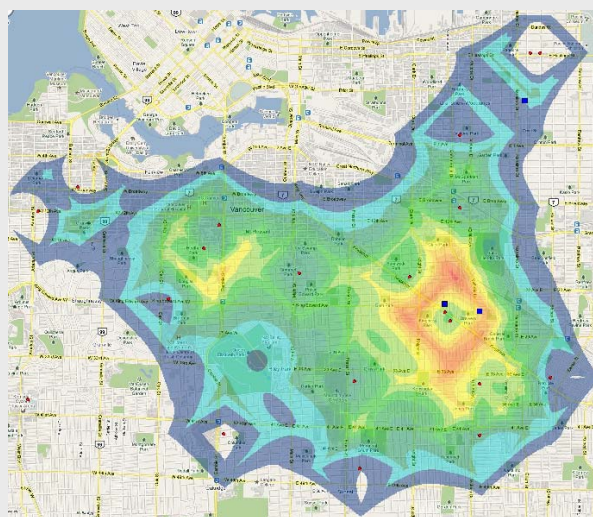
**KEY POINT:** The locations analyzed must be geographically connected to a common home base, e.g., crimes committed by the same offender traveling from their home to each of the crime sites. This is a fundamental requirement for geographic profiling.



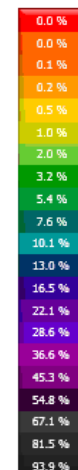


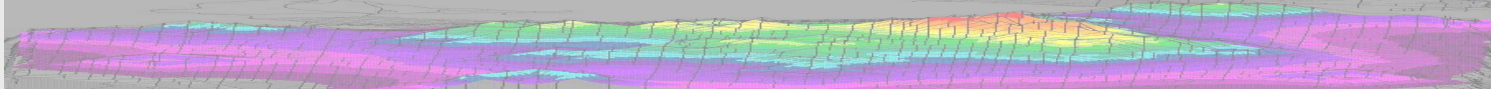
## Geographic Profiling – Results

Geographic profiling produces a raster-grid probability map which shows the likelihood of the home base being located in each grid cell on the map. This map is called the geographic profile (or geoprofile for short). It is often represented as a color map where color corresponds to likelihood score.



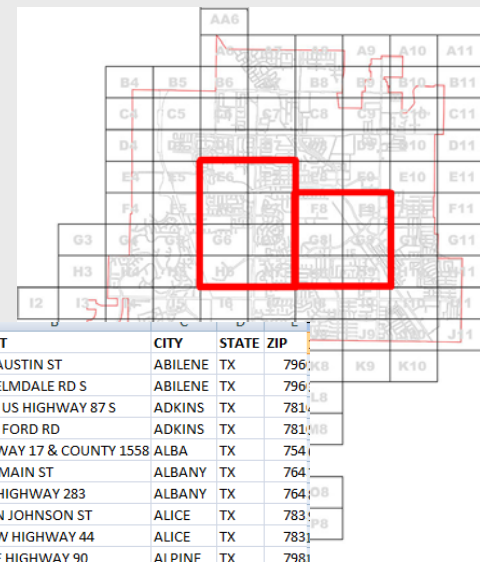
Hit Score





# Geographic Profiling – How it's used

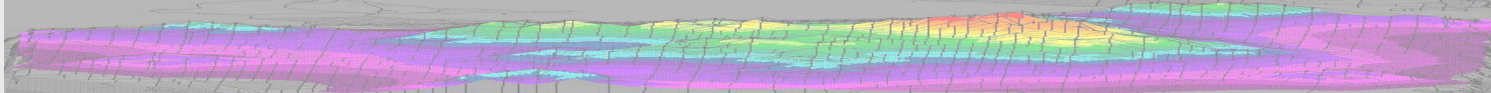
The geoprofile is normally used as part of an information management strategy to filter information and to focus and direct other analysis techniques and further investigations.



|    | NAME                  | STREET                   | CITY     | STATE | ZIP   |
|----|-----------------------|--------------------------|----------|-------|-------|
| 1  | LOMAR TAXIDERM        | 1401 AUSTIN ST           | ABILENE  | TX    | 79601 |
| 2  | HAMMER'S TAXIDERM     | 1711 ELMDALE RD S        | ABILENE  | TX    | 79605 |
| 3  | VERRIPS TAXIDERM      | 10655 US HIGHWAY 87 S    | ADKINS   | TX    | 78101 |
| 4  | NOURI'S TAXIDERM      | 11465 FORD RD            | ADKINS   | TX    | 78101 |
| 5  | LAKE FORK TAXIDERM    | HIGHWAY 17 & COUNTY 1558 | ALBA     | TX    | 75401 |
| 6  | ROCKER B TAXIDERM     | 401 S MAIN ST            | ALBANY   | TX    | 76401 |
| 7  | STACY HARGROVE        | N US HIGHWAY 283         | ALBANY   | TX    | 76401 |
| 8  | L ADAMS WOODWORK PLUS | 1198 N JOHNSON ST        | ALICE    | TX    | 78301 |
| 9  | S G BRISENO TAXIDERM  | 3717 W HIGHWAY 44        | ALICE    | TX    | 78301 |
| 10 | HIP-O TAXIDERM        | 2801 E HIGHWAY 90        | ALPINE   | TX    | 79801 |
| 11 | C D TAXIDERM          | 103 WOFFORD LN           | ALVIN    | TX    | 77501 |
| 12 | DANNO'S TAXIDERM      | 14004 SILVIA LN          | ALVIN    | TX    | 77501 |
| 13 | R W HUMBIRD TAXIDERM  | 4955 CHARNOCK DR         | ALVIN    | TX    | 77501 |
| 14 | TROPHY TAXIDERM       | 1820 N WESTERN ST # A    | AMARILLO | TX    | 79101 |



**KEY POINT:** The geoprofile is not intended to find a specific point on the map where the home base is most likely located, i.e., it's not "X marks the spot".



## What information do you need?

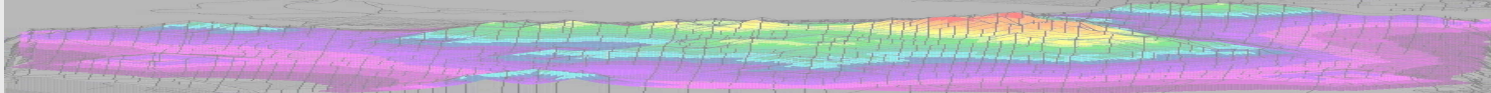
A geographic profile is based on a set of incident locations, so the minimum you need to prepare a profile is only those locations and your Rigel geoprofiling software...But



Before you even think about preparing a geoprofile, you need to consider a few things:

- Does this set of locations fit the required model?
- Are any key assumptions violated?
- Is this the right set of incidents to profile?

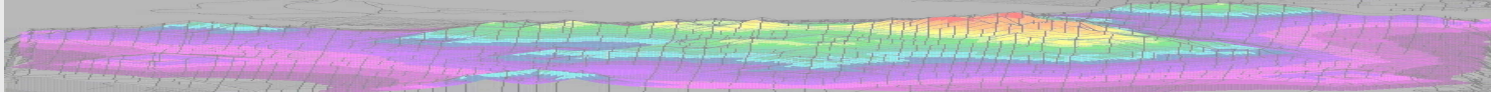




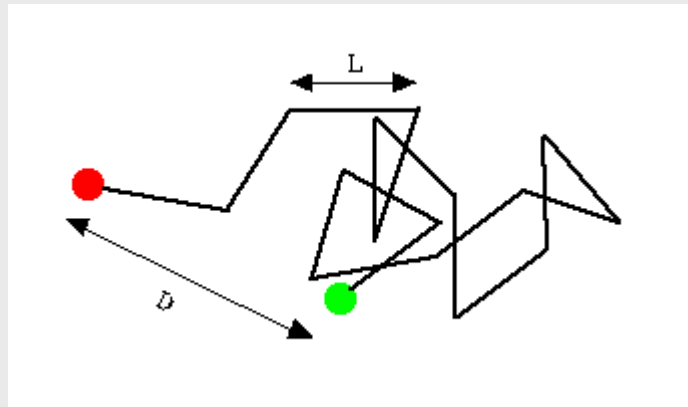
## Geographic Profiling Model

- It is essential for any qualified practitioner of geographic profiling to have a good mental model of how it works, in order to ensure that they are analyzing the correct data in the correct way.
- If you apply geographic profiling to any arbitrary set of crime locations without a good understanding of how the data fits the required model, the results may be no better than random chance.





# Geographic Profiling Model



The core model is that for each crime, the offender sets out from their home base in search of a suitable target or victim, and commits a crime where they find one.

# Geographic Profiling Model

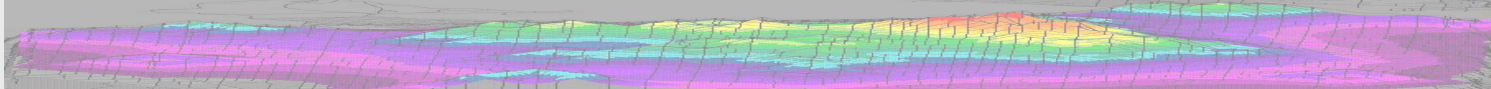
## Essential Elements

This core model has some very important elements:

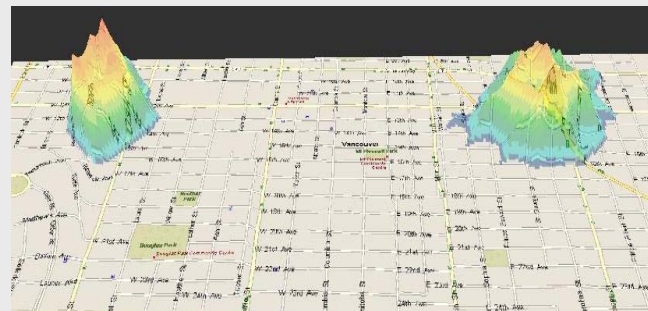
1. The offender has a single stable home base throughout the series of crimes.
2. For each crime, the offender finds their target or victim in the course of a geographic search originating from that home base.
3. The offender commits the crime where they find their target or victim.



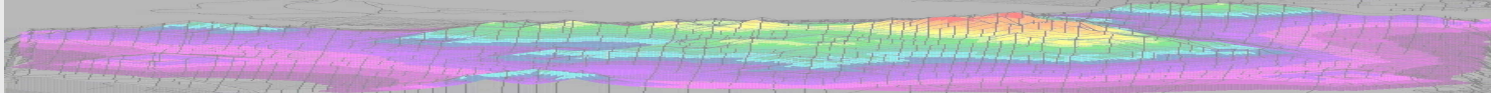
Let's look at each of those elements in more detail...



## Geographic Profiling Model Stable Home Base



- If the offender has more than one base from which they commit their crimes, or their home base changes during the crimes series, it will distort and potentially invalidate the geographic profile.
- In some cases it may be possible to distinguish that there is more than one base in the pattern of the profile, for example if there is one distinct base for the early crimes in a series and a different distinct base for the later crimes.



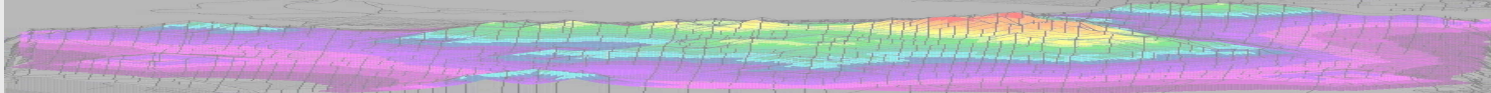
# Geographic Profiling Model

## Geographic Search



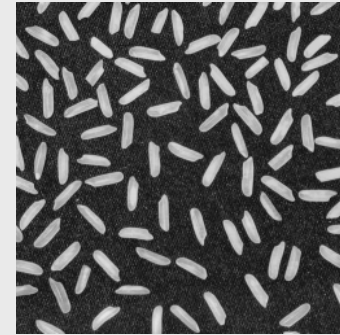
- A geographic search is one based on moving through the physical environment.
- If the offender does not conduct a geographic search for targets, then a geographic profile is not applicable.
- For example if an offender finds potential victims on the internet, or in obituary notices in the newspaper, their search is not geographic.



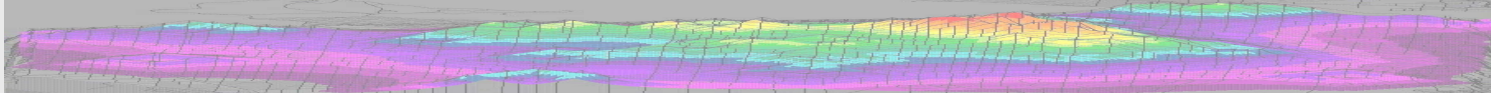


## Geographic Profiling Model

### Uniform Target Backcloth



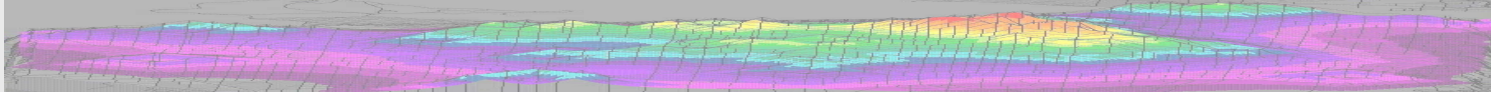
- The target backcloth is the general availability of crime targets in the environment.
- If the targets are rare or very unevenly distributed, it may distort or invalidate the geographic profile based on those sites.
- For example, if a serial rapist attacks prostitutes who are all picked up in a small red-light district, the target backcloth for the encounter sites is very non-uniform. However the victim release sites might be more distributed and more significant.



# Geographic Profiling Model Journey From Home Base



- Our model is based on the offender returning to their home base between crimes.
- If the offender does not journey from their home base to the crime site for each of the crimes, then the basis for a geographic profile is missing.
- For example, if an offender takes a long trip and commits offenses at various stops along the way, the individual crimes do not each represent an independent journey from the home base.



# Geographic Profiling Model

## Encounter Versus Action

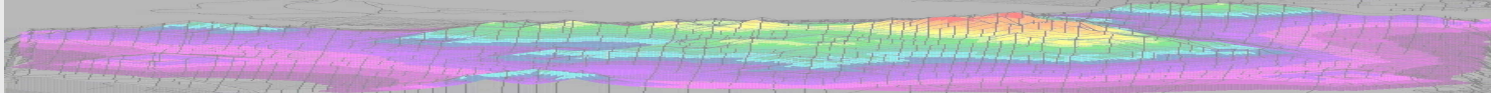


- Our model assumes that the offense is committed where the target or victim is encountered.
- Even if the target or victim is encountered in the course of a search originating from the home base, if the crime does not take place there, there may be no basis for a geographic profile of the crime sites.
- For example, if the offender follows the victims a long way from the encounter site, the ostensible crime site is not the encounter site.
- Notice the importance of where, but not necessarily when: Offenders often remember the locations of potential targets they encounter for future crimes.

## Target Selection Victim



- It is often important to understand how the offender is selecting targets in order to be sure that the requirements for geographic profiling are met.
- If the crimes are routine (e.g., property crimes), the target selection is usually routine too, but crimes driven emotional behavior such as rape and murder may be more complex. Additional training is strongly recommended for profiling these types of cases.

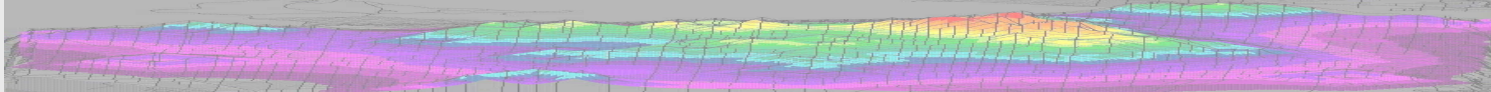


## Target Selection Location + Time



- A visit to the crime site at the time and day of the week the crime took place may help clarify understanding and produce some insights.
- For example an area which initially appears to be a quiet backwater might be busy during a weekly market on Saturday morning..

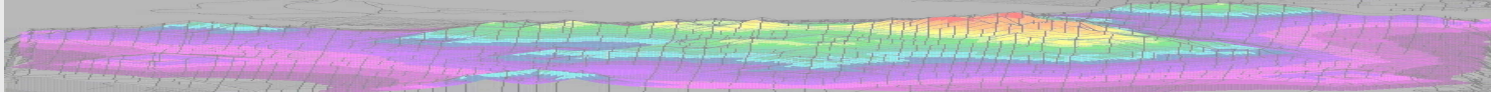




## Series Linkage



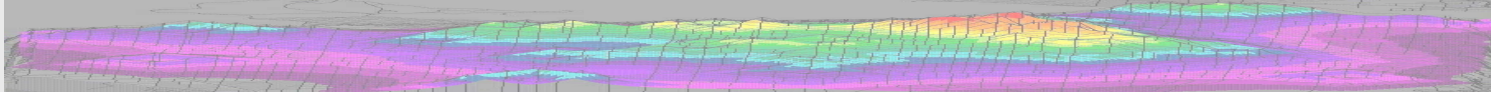
- A key assumption is that all the incidents being profiled are correctly linked to the same offender. While some uncertainty and error can be tolerated, a significant number of linkage errors may weaken or distort the geoprofile.
- Linkage analysis is therefore an important precursor to geographic profiling. Training in linkage analysis and the use of available tools for linkage verification are recommended for geographic profilers.



## Series Completeness



- In some cases the crime series being profiled may be incomplete. Reasons could include non-reporting from adjacent jurisdictions, poor linkage analysis, or not going back far enough historically.
- Missing crimes become a problem when they result in a geographic bias. This is particularly the case when some jurisdictions are not reporting (e.g., if only the West district is reporting, you don't know if there are also linked crimes in the East district).

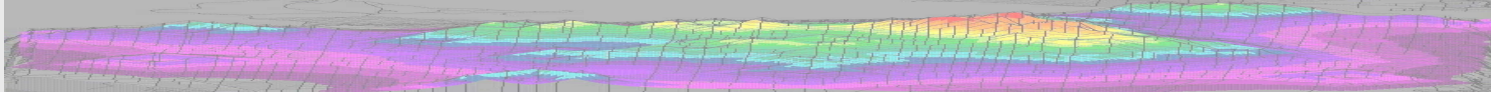


## Practical Solutions to Problems

- There are ways to work around many of these problems in practice. For example, you might interview stalker victims to figure out where they first encountered the offender.
- You should take a course in applied geographic profiling for a more thorough grounding in recognizing common problems and working around them.



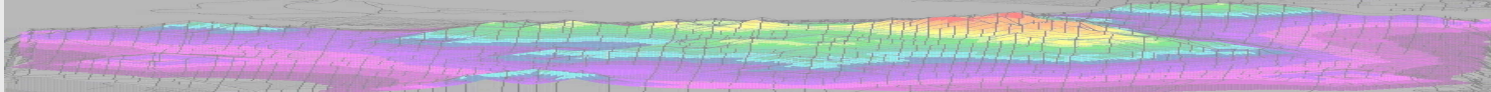
**KEY POINT:** Good geographic profilers know what not to profile!



# Investigative Strategy



- Geographic profiling is meant to be a practical tool for crime investigation. The profile is only as useful as the investigative strategies by which you employ it to help solve the crimes and arrest the offender responsible.
- An important part of every geographic profiling analysis is therefore to recommend appropriate investigative strategies.



# Investigative Strategy

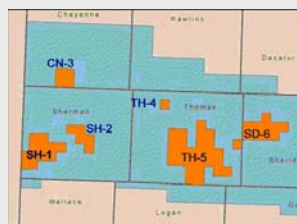
## Two Basic Categories

- A wide range of investigative strategies is available, but they basically fall into two categories:

a) Suspect prioritization



b) Target Area focus



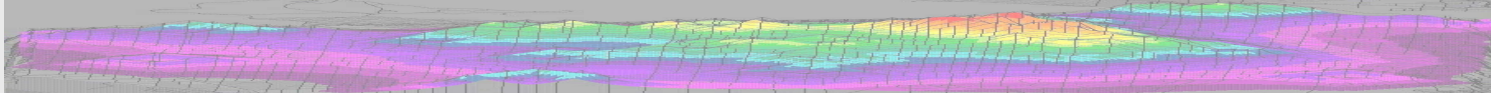


# Investigative Strategies

## Suspect Prioritization



- Any suspect location with an address or geographic coordinates can be compared to the profile and ranked in order of likelihood to be the home base.
- Most records are tagged with addresses these days, making it easy to conduct this type of ranking by a database search.



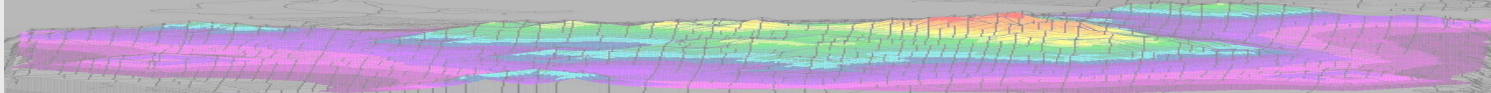
# Investigative Strategies

## Suspect Definition



By “suspect”, we mean “suspect location”, not necessarily a person. It can be any type of location which could be the home base for the series:

- Residence
- Alternative bases such as work or school
- Local bases of convenience such as a train station or shopping mall
- Locations with potential connections to the crimes, such as stores used to purchase weapons or supplies



## Investigative Strategies

### Home Base = Home?



- A common investigative strategy for using a geographic profile is to compare the home addresses of suspected offenders against the profile.
- But what if the home base is not the home address of record for the offender?

# Investigative Strategies

## Alternative bases

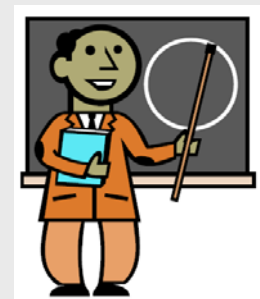
- Offenders may move frequently, and home address records may be out of date. Some may be transient, staying in motels or homeless shelters.
- Offenders may operate from a base that is not their home, e.g., their work, their school, homes of family or friends.
- Offenders may operate from a local base of convenience such as a train station, parking lot, park, shopping center, drug market. Such offenders are known as “poachers” or “commuters”.



# Investigative Strategies

## Interpretation of Suspect Locations

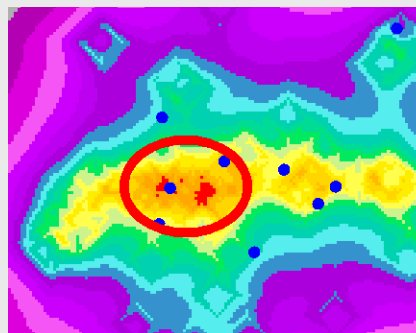
- Investigators with good practical knowledge and experience may recognize from the crime characteristics that the offender's home base is likely not their home address, and alter their investigative strategy to look for a different type of home base.
- Many academic studies of geographic profiling use historical crime records and rely too much on the offenders' home address of record, something the case investigator at the time would not have done.



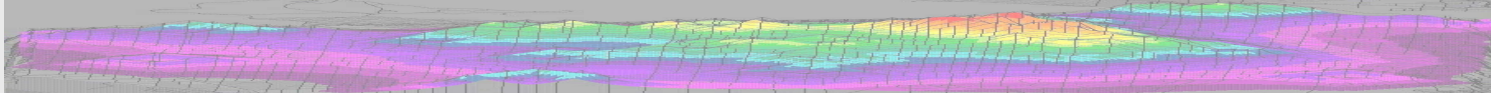


# Investigative Strategies

## Target Area



- The geographic profile produces a probability map which can be used to select areas most likely to contain the home base for the series.
- The statistics of the profile can suggest how large the selected area needs to be in order to have a reasonable probability of containing the home base.
- The highest-likelihood areas may be many and scattered with a weak profile, but with a strong profile they are likely to be few and contiguous, lending themselves to target-area strategies.

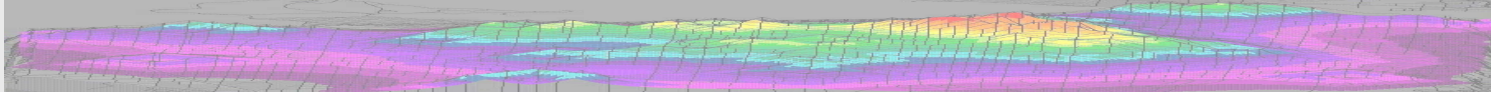


# Investigative Strategies

## Target Area Strategies

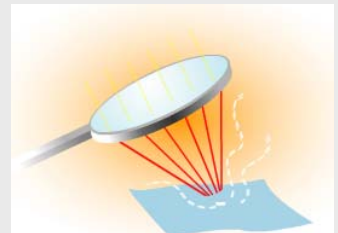
- Target area strategies can include:
  - Focused records searches
  - Door-to-door canvassing
  - Surveillance
  - Increased patrols
  - Checkpoints at entrances and exits
  - Notices to the public



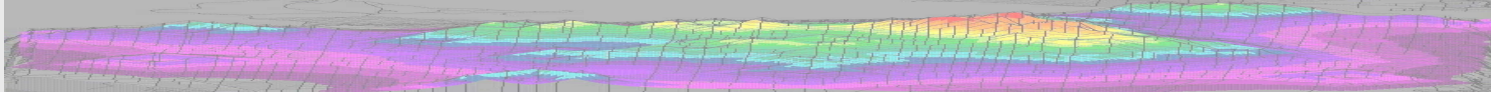


# Investigative Strategies – Summary

- A geographic profile is never used on its own to solve a crime – it is always combined with other sources of information and other tools.
- The geographic profile is used to improve the geographic focus of the investigation, reducing the number of suspects and prioritizing them, or suggesting target areas for closer investigation.
- On average a geographic profile improves the geographic focus of the investigation by a factor of 10x \*



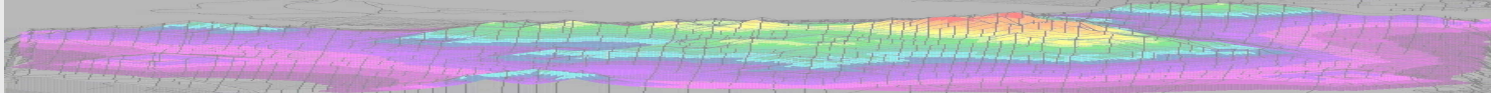
\* Historical results of actual police investigations analyzed over a period of 5 years.



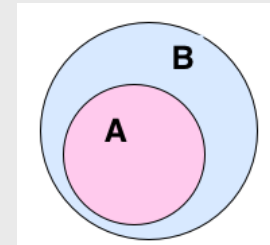
# Investigative Strategies – Summary



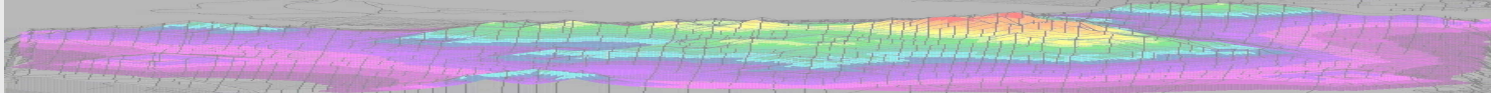
- There are many possible investigative strategies for using a geographic profile, and investigators have come up with some very innovative ones over the years. For example a geoprofile might be used to deliberately displace an offender from their preferred base to one where they will more easily be apprehended.
- A course in practical geographic profiling is strongly recommended for more information on investigative strategies.



## Scenarios



- A Scenario is a subset of all the crimes included in the case. It represents a theory about which crimes are the best for analysis.
- The full set of crimes is called the Base Case scenario.
- The primary reason to develop a scenario instead of using all the crimes is that some crimes should be excluded because they do not fit the model or they violate an assumption.



## Scenarios Outliers

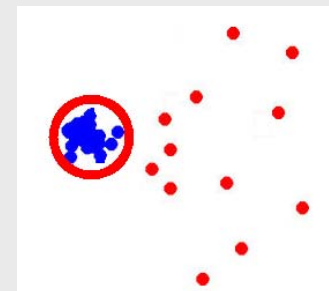


- **Outliers** are crimes that do not fit the normal pattern seen in the series. They could be too distant from the other crimes in space or time, or they could represent some other type of anomalous behavior (e.g., the one and only time the offender apparently used a car instead of being on foot).
- Outliers should be excluded from the scenario used for geographic profiling.

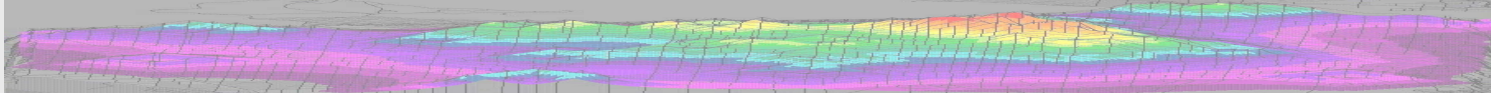


# Scenarios

## Independent Journeys



- **Non-independent journeys:** If multiple crimes are too close to each other in space and/or time, they may not each represent an independent journey from the home base to the crime site (for example a spree of small arson fires in one night along the same street).
- In this case only one crime of the group should be included in the scenario, preferably the initial site or the one that maximizes the spatial and temporal spread of the scenario if the initial site cannot be determined.

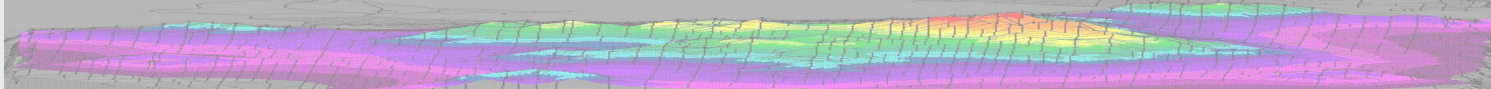


## Scenarios

### Location Types

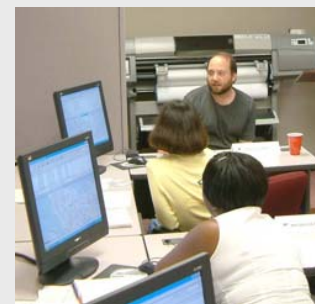
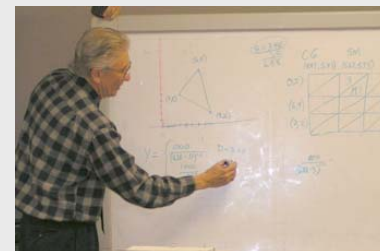


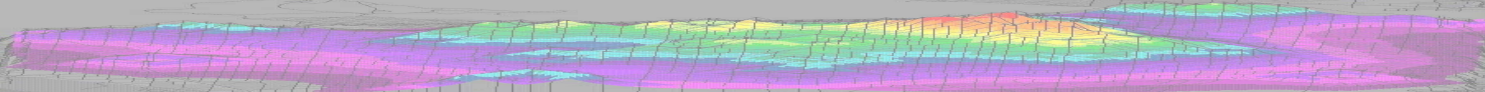
- If a case includes multiple types of locations, each type may represent a different type of journey and even a different home base. Scenarios can be used to analyze the different types of locations separately.
- For example a serial killer probably uses different criteria for where to dispose of a body than where to find a victim. The victim encounter sites and the body dump sites should usually be profiled separately, even though they are linked to the same offender and offenses.



# Training vs. Software

- Geographic profiling relies on a trained analyst's understanding of how to apply a model of human behavior to a real-world situation. The model and the technique must be taught – not all aspects are obvious or intuitive.
- The purpose of geographic profiling software is to assist the analyst, not to substitute for training.
- Professional Geographic Profiling Analyst (GPA) training is widely available in the form of courses hosted by police training agencies.





## Review: Common errors in geographic profiling

- Profiling a series which is unsuitable for geographic profiling
- Working from published historical data without access to contemporary police knowledge and records
- Failure to obtain a complete data set
- Ecological fallacies in calibration
- Theory of crimes incompatible with scenario
- The “X marks the spot” mind-set
- Assuming that a violation of assumptions is an insurmountable problem
- Not recommending valid investigative strategies