Technical note

Introducing geographic profiling crime analysis in Mexico: principles of geographic profiling, examples of its use, training and challenges in its implementation

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Abstract

Geographic profiling is an investigative method that uses the locations of connected group or series of crimes to determine the most probable area of offender residence, or some other location (e.g., place of work) from which offender anchors their activities. Geographic profiling can help investigators to better understand offending behaviour, and from this help identify the offender (or suspects), or determine where to target an investigate strategy. Geographic profiling has been applied to a wide range of crime types including murder, rape, assaults, robbery, vehicle theft, fuel theft, metal theft, kidnapping and abductions, and criminal damage.

To introduce skills in geographic profiling in Mexico, a certified geographic profiling analysis program was introduced in 2018, with 12 analysts from federal police and security agencies attending. The two-week course included exams and practical exercises, and was followed by a four-month period within which analysts were required to complete an operational report to achieve full certification. Due to changes in the government in Mexico over this time that affected the employment of those who completed the two-week training, only two analysts completed the full certified operational program by completing operational reports. Although, the current level of skills in geographic profiling in the federal police and security agencies is still very low, the training program and the operational reports that were completed have shown the potential in how geographic profiling can be used to assist criminal investigation in Mexico. Of note is that the analysts who attended the course have gone on to use the skills they acquired to analyze where missing people have disappeared to, to help target the deployment of highway patrols for reducing cargo thefts, and inspire a new research theme that is examining how geographic profiling can be used for generating geographic intelligence about organised crime groups that can help in their detection, disruption and the deterrence of their criminal activity.

Contents

Figures

Abbreviations

CNS - Comisionado Nacional de Seguridad

IDB – Inter-American Development Bank

SNA – Social Network Analysis

UCL – University College London

1. Introduction

Geographic profiling is a criminal investigative technique that uses the analysis of the locations of a connected series of crime to determine where an offender most likely lives, or bases their activities (e.g., place of work, base from which the search for victims commences, transport access points on offending routes and other major offender activity locations). Its application has been significant in helping to solve a number of major serial crime investigations (such as investigations for murder and rape) and its use is now being more applied to a wide range of criminal behaviour - this includes robbery, kidnapping, vehicle theft, metal theft, arson, sexual assault, harassment, burglary, and criminal damage. The principles of geographic profiling have also been applied to non-serial crime investigations (i.e., involving single incidents) such as child abduction cases. Prior to the commencement of this skills development program, no police agency in Latin America or the Caribbean has personnel with certified skills in geographic profiling analysis.

As part of a program of work in improving police effectiveness in Mexico, the Inter-American Development Bank (IDB) have been supporting an initiative to help strengthen the competence and use of crime analysis. A specific part of this support involved introducing geographic profiling skills into the Mexico Federal Police and the National Commission for Security (Comisionado Nacional de Seguridad), and pilot the application of these skills in helping to inform criminal investigation for crimes such as robbery, kidnapping, murder and arms trafficking. Mexico continues to experience citizen security concerns – it is one of seven countries in Latin America that persistently experiences homicide rates greater than 10 per 100,000 inhabitants, with 2019 experiencing the highest number of homicides since records began in 1997. Strengthening the competence and use of crime analysis is considered to be a vital part of helping improve how the police in Mexico understand and respond to crime issues and tackle organised crime groups.

There are approximately 430,000 police officers in Mexico, operating across three jurisdictional levels: municipalities, states and the federal level (which since May 2019, the latter has been reorganised within a National Municipal Guard which also involves additional officers from military services). Whilst each level requires analytical support, the

4

introduction of geographic profiling skills was to the federal level. In Mexico there are approximately 5,000 crime analysts working in local police departments across the country and 500 working at the federal level (see Chainey and Guerrero, 2019 for more details on how their duties are arranged). Prior to the commencement of new pilot training program in geographic profiling, Mexican federal police services did not possess any skills in geographic profiling.

In November 2016 the Mexico National Conference of Secretaries of Public Security created the National Network of Public Security Analysts (NNPSA). Whilst analysts have been working in the police prior to November 2016, the objective of the NNPSA is to implement and formalise an effective process for crime analysis that helps to standardise and further develop the knowledge and skills of analysts working in police departments across Mexico. This program of work was led by the Comisionado Nacional de Seguridad (CNS). The CNS included within its functions the strategic planning and development of programs that can help improve security, and the analysis that underpins this function. In many situations these activities are performed by federal police services, and includes identifying potential ways that federal policing activity can be improved through skills development in specialised analysis techniques.

In May 2018, the CNS, supported by the IDB and with an international contribution from University College London in the United Kingdom embarked on a six-month geographic profiling analysis skills development program. The program involved the attendance of twelve analysts from the CNS and the Mexico Federal Police in a skills development program that was delivered over two training blocks, followed by an opportunity to complete an operational profile. The inclusion of analysts from the federal government was useful as it was designed to help improve communication links between the federal government and the federal police, and to collectively help determine how geographic profiling could be used in practice.

This technical note provides information about the principles of geographic profiling in its application for supporting criminal investigation, details on the content of the training

blocks delivered in Mexico, information on the types of skills that are developed as part of the training program (and to do geographic profiling effectively), and details on the software that are used to support geographic profiling. Examples that illustrate the use of geographic profiling are included in the first sections of the technical note (albeit, examples not from Mexico) to help demonstrate the practical use of the technique. In section 6, extracts of some of the examples of geographic profiling to support investigations by the analysts from the federal police who attended the course are included. Full details on these geographic profiling results cannot be included due to the classified nature of these results and the restricted nature of the content of these cases. Instead, these examples from Mexico (and elsewhere) are designed to provide an indication of how geographic profiling can be used to support criminal investigations in Mexico. Section 6 also discusses several of the key limitations of geographic profiling and its implementation in Mexico, but also introduces a new research program on the use of geographic profiling for the investigation of criminal groups that involves one of the analysts who attended the geographic profiling training program.

The training the analysts received from UCL is the only internationally recognised certification training program in geographic profiling analysis. Further details on this certified training program are provided in section 7.

2. Principles of geographic profiling

2.1. Solving crime

There are only three ways a crime can be solved (i.e., an offender is identified and charged for the offence): through a witness statement, from a confession by the offender, or from physical evidence. In an investigation the search for information to solve a crime follows a path outwards from the victim and the crime scene. In most cases, when a crime is solved (i.e., and offender is charged by the police) this outcome is reached because the victim knows the offender in some way. Crimes committed when there is no association (or clear association) between the victim and offender are much more difficult to solve – these are often referred to as 'stranger crimes' i.e., committed by a stranger. Working outwards from the victim to identify the offender in these cases is difficult because of the lack of any clear

association between the victim and the offender. In situations when it is difficult to identify the offender or gather sufficient evidence (for stranger and non-stranger crimes), the alternative is to work inwards, trying to establish some link between potential suspects and the victim, or some link between the potential suspects and the crime scene. For example, a person is kidnapped by a stranger and a ransom note to the person's family is issued. As there is no clear association between the victim and the offender, the alternative is to explore in more detail why the offender chose this particular person to kidnap (i.e., it was unlikely the kidnapping was completing random and some degree of planning must have been involved), and examine if there is some link between the location where the person was abducted and the offender.

A key challenge with any investigation involves how to make the best use of the data available. It is often typical with many investigations that very little information may be available or in some cases, huge volumes of information may exist but it is not clear on which information to use. In either case, a prioritisation strategy is required that is focused towards collecting specific information or prioritising the assessment of information. Investigative prioritisation strategies to help identify the offender often seek to determine some physical characters of the offenders (e.g., male, athletic build, 180 cm tall, white, brown hair, clean shaven, wearing a dark coat) or behavioural characteristics (e.g., violent, stole an item of clothing from the victim, or the offender's modus operandi, such as how they approached the victim, what they said and the acts they performed in the actual commission of the crime). Physical descriptions of offenders can often fail to be specific in who the offender is, and psychological profiling can often be subjective. Geographic profiling provides a scientific means of supporting the prioritisation strategy of an investigation by helping to determine certain geographic characteristics of the offender's behaviour, and as a result help inform the type of investigative strategies to deploy to help catch the offender. In particular, when the same offender commits more than one offence, patterns in their geographic behaviour can begin to be observed and help to further prioritise investigative focus.

2.2. What is geographic profiling?

Geographic profiling is an investigative method that uses the locations of connected group or series of crimes to determine the most probable area of offender residence, or some other location (e.g., place of work) from which offender anchors their activities. Geographic profiling can help investigators to better understand offending behaviour, and from this help identify the offender (or suspects), or determine where to target an investigative strategy. Geographic profiling was initially used for stranger violent crime (such as murder and rape), but is now applied to the full range of crimes that are considered to have serial qualities. Geographic profiling can also be applied to single offences, in particular where there is additional geographic information for these offences beyond where the offence took place. That is, geographic profiling involves not only using information on the location of offences, but can use other geographic information related to the offence such as the last location where the victim was seen, and where items of property of the victim were found or used (e.g., a stolen credit card or cell phone).

Geographic profiling is based on what is most likely, following an analysis of data, rather than being an 'x marks the spot' approach. In the sections that follow, this principle of 'what is most likely' will be illustrated. Also, geographic profiling is not a 'silver bullet' or a substitute for good investigative work – it is a technique that can be used as part of the investigative process.

2.3. Theoretical principles underpinning geographic profiling

Geographic profiling draws from three key theoretical perspectives: crime pattern theory; the routine activity perspective; and rational choice.

- The *routine activity perspective* is based on the simple idea that for a crime to occur, three components are necessary. There must be the presence of a likely offender, the presence of a suitable target, and the absence of a capable guardian. These three components – offender, target and lack of a guardian – must meet in time and space to provide the necessary chemistry for crime. This meeting in time and space is not random but is dictated by the natural rhythm of daily life – people going about their routine activities. The routine activity perspective does not just consider offenders, targets and guardians, but adds the important qualifiers to each of these components. That is 'likely'

8

offenders (i.e., some may will lack the technical knowledge and skill to attack certain types of premises), 'suitable' targets (i.e., some targets may be inaccessible or too well defended) and 'capable' guardians (many objects and people can be guardians, however at different times they may not be capable in acting in this way). The combination of these three components and their qualifiers then dictates that the risk of crime changes over time with the movement of people throughout the daily routine activities of their lives. That is, as these meetings in space and time are not random, the patterns observed in data relating to human behaviour could be considered in relation to these routine activity principles.

- The **rational choice perspective** provides a framework to consider offender decision-making when a crime opportunity is presented. It can also be used to consider likely strategies that will influence the decision-making of the offender. Most offenders are known to make some sort of decision to commit a crime by weighing up some of the pros and cons (i.e., the rewards, against the chance of being caught). This suggests committing a crime is a (fairly) rational decision, and that an offender will commit an offence while trying to achieve some sort of desire or goal. This goal may be to derive personal gain, as in burglary or theft, or personal pleasure.

  The criminal decision-making process can generally be considered as involving two parts. The first involves a long-term, multi-stage decision to become generally involved in criminal activity (criminal involvement decision). The second part is a shorter-term, more immediate decision (the criminal event decision) to grasp an opportunity that is presente). For the purposes of geographic profiling, it is the second theoretical concept of the criminal event decision that is of most interest. On its own, the theoretical principles of rational choice do not necessarily determine the spatial patterning of crime. However, in combination, an understanding of the influence of routine activities and the decision-making of an offender helps to then inform a model for the interaction between offenders and victims – crime pattern theory.

- **Crime pattern theory** can help explain where and when crime is likely to occur. Crime pattern theory helps to bring together the two areas of offender spatial distribution and offence spatial distribution by examining the relationship of the offence to the offender's habitual use of space. Crime pattern theory suggests that offenders are

influenced by the daily activities and routines of their lives, so that when they are searching for a criminal opportunity, they will tend to steer towards areas that are known or most familiar to them. These areas make up what is termed the offender's *awareness space*. In an offender's day-to-day activities they will be watching for targets that have no guardians, in areas they are more aware of (and feel more comfortable) rather than in areas in which they are not familiar.

An important concept that is central to crime pattern theory is the general theoretical principle of least effort. This principle dictates that there are spatial limits to the geographical coverage of an offender's awareness space and why an offender chooses a particular location to commit crime. While increased distance to commit crime increases the effort, it also increases the risk of crime commission, and increases the possibility that the offender will stray into an unknown area. This theoretical concept of minimising the distance travelled to commit crime is supported by a wealth of empirical research that has shown that the majority of offender journeys to crime tend to be short. The least effort principle is, therefore, a useful mechanism for thinking about the geographical extent of an offender's spatial behaviour and the crime patterns that may result.

Furthermore, an offender's choice of location for where to commit a crime and the patterns that result can additionally be explained in terms of how opportunities to commit crime concentrate - either in terms of areas where large numbers of people are located or where other targets are present for reasons unrelated to criminal motivation, or places which create criminal opportunities and in doing so attract offenders.

Crime pattern theory provides a model to help explain why an offender chooses a particular location to commit a crime. It illustrates that this decision-making is informed by the offender's awareness of the area and the familiarity of opportunities (influenced by their non-criminal daily routines), and is often influenced by their previous experience of crime commission. Crime pattern theory, therefore, provides a theoretical explanation for why spatial patterns of crime are not random and can be predicted.

Crime pattern theory and the least effort principle provide a framework for helping to understand the criminal spatial landscape. The awareness spaces referred to in crime

pattern theory are made up of different structures which provide a changing pattern of opportunities to commit offences depending on the environmental backcloth – the social, psychological, economic, physical and temporal mosaic of the landscape which the offender passes through. The knowledge an offender builds of this landscape (their awareness space) can be informed by previous criminal commission, but is also heavily associated with their non-criminal routines. That is, offenders also have to shop, visit people, and perform other non-criminal activities as part of their normal, non-criminal routines, and in so doing develop their awareness and familiarity of locations they go to, the area surrounding these locations, and the paths they take between these locations. Across this space, opportunities for criminal commission are not equal, and therefore affect the type of criminal opportunities that are available to the offender. This means that the offender cannot just offend wherever the wish to offend in their awareness space, but are constrained to where opportunities are present.

The motivations of the offender are also bounded by a degree of rationality in their decision-making. Offenders prefer to commit offences in areas where they are comfortable, where risks are lower, and in their preference to minimise effort. The theoretical explanations for the criminal spatial landscape, therefore, provide the source for helping to interpret the spatial patterns observed in crime data, help determine why crime may occur in certain locations rather than others, and can help determine why the offender chose this location over other locations. Recalling a statement in the section on 'solving crime', the alternative for investigators when there is no clear association between the victim and the offender is to work inwards, trying to establish some link between potential suspects and the victim, or some link between the potential suspects and the crime scene. Drawing from the theoretical principles that underpin geographic profiling, investigators can begin to consider why the offender chose this particular person (or target) to commit their crime against (i.e., was it just a case of the victim being in the wrong place at the wrong time, or was it something about them that made them a suitable target), and examine why the offender chose this particular location. The location acts as clue, because it is likely the offender's spatial behaviour has been influenced by their awareness space, the principle of

least effort and an assessment of the risks that helped them to determine where they commit the majority of their criminal acts.

2.4. Creating and interpreting a geographic profile

A geographic profile map is constructed using a complex algorithm that takes into account mathematical models, journey to crime distances, and the relationship between crime location sets and offender residence. The most used software for supporting geographic profiling is Rigel Analyst. Other software options do exist, including Dragnet, CrimeStat and modules for geographic profiling in the programming environment R, but Rigel is the software of choice by those who conduct geographic profiling within police agencies.

The process involved in creating a geographic profile involves much more than just entering locations into a software application and running an application that generates a map from these data points. First, an assessment of the criminal case and each crime location is required to ensure the data are adequate and useable. Next, an assessment of the linkage between the offences is required to ensure the analyst is satisfied with the linkage between crime sites that has been made by others, or analyse for themselves the linkage. This may result in the analyst deciding certain crimes are definitely not linked, certain crimes are less likely to be linked, or identify crimes that were missed by others and that show a high degree of certainty in being linked. The examination of the data also includes evaluating the characteristics of the modus operandi of each offence, the overall geographic distribution of the crime series, and the temporal characteristics of the series (i.e., when the offences took place, by season, day of the week, and time of the day). Then, crucial to their analysis of the crime series, the analyst needs to consider questions such as:

- What is the likelihood of this offender encountering the target, absent of a capable guardian?
- Did/could the routine activities of all (offender, target, guardian) produce this intersection in time and space?
- What do the locations of the crime sites tell us about the choices the offender may have considered?
- What might have influenced the offenders behaviour in the selection of where to commit the crime i.e., considering risks and effort?

- Has the offender's decision-making changed over time, based on differences in the characteristics of the crime series?

- Did the offender 'choose' the location of the crime sites (based on his/her awareness space), or was this more guided by the opportunity space or target availability?

- Is the offender likely to have travelled a short distance to the crime sites i.e., is he/she local?

- Is the offender following a particular crime template i.e., is he/she drawing from similar environmental cues to influence his crime preferences?

- Is the offender choosing specific types of targets?

- Are the offences occurring in places where there is a lack of formal or informal control?

- Does the layout of the streets or the remoteness of any of the crime sites help tell us something about the spatial behaviour of the offender?

- Are the temporal features of the offences based on the target opportunity structure and/or the offender's own availability?

- Are there multiple locations that relate to the crime event i.e., an encounter site that is separate to the attack site, that is separate to the body deposition site?

- Are there any other locations that are associated with the crime event and how might they be used to assist the geographic profile e.g. use of stolen credit card, location where an item of clothing from the victim was found?

- What 'hunt' and 'attack' method is the offender employing?

- Were the victims in motion during the crime or just prior to the crime?

- What do all of the victims have in common?

- What spatial overlaps do the victims have e.g., they all frequented the same bar, or travel along a similar route at some point in time in their daily lives?

- What does the hunting ground tell us about the offender's awareness space and comfort zone?

- Is there any evidence or indication that the offender's spatial behaviour may have been displaced, and why?

- As the journey to crime tends to be short, is there any evidence to suggest the offender is unlikely to be local?

- How might the age, experience and type of crime the offender is committing influence the journey to crime distance?

- Is the journey to crime likely to start from the offender's home or some other location?

- What's the offender's likely mode of travel and how is this likely to influence their spatial offending pattern?

- Are there any physical barriers that may impact upon the offender's journey to crime?

- Does the offender have a preference to return to a location multiple times (to commit crime) and how might this be useful in determining the offender's spatial behaviour decision-making process?

- How confident are you that the linkage is accurate and complete – is there an opportunity to test different scenarios and compare geographic profiling mapping results?

- Is there any evidence of pre of post offence movement by the offender and how might this be useful in interpreting the offender's spatial behaviour?

Considering and answering these questions are central to the interpretation of any geographic profile map showing peak areas. A geographic profile map is produced by assigning scores to the various points on a map that represent the offender's 'hunting' area. These scores are based on the crime site locations and certainty in the linkages between crimes. The map output of a geographic profile, also often called a 'jeopardy surface', identifies the most probable area of offender residence, or location where the offender likely anchors their activities. Figure 1 provides an example of a map generated using the Rigel Analyst software. The map shows crime sites, and a peak area (in yellow), indicating the offenders anchor point, based on the distribution of the crime sites. It is for the trained geographic profiling analyst to determine what this peak indicates (e.g., is it where the offender lives, or the location from which they begin the hunt for their victims) and how it can be used to assist an investigation.
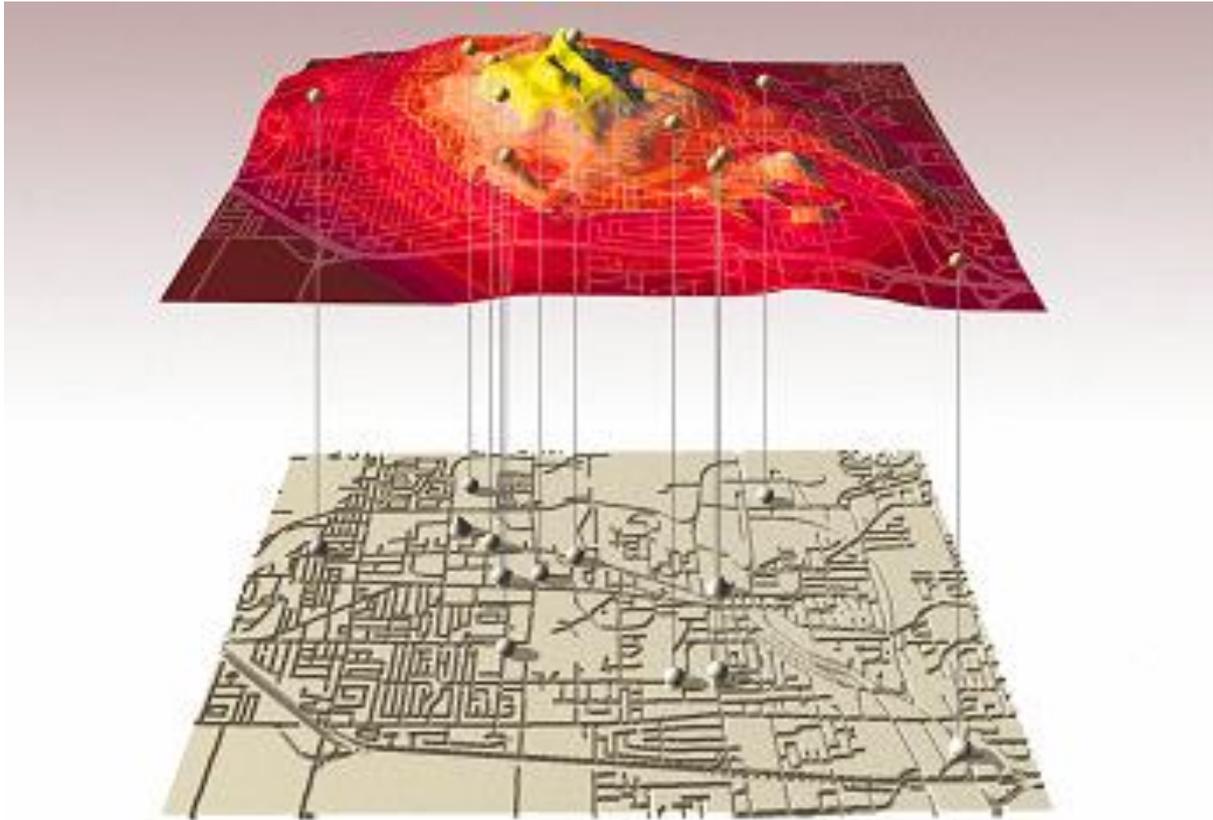
Figure 1. A geographic profile map, or jeopardy surface.   This map shows a three dimensional probability surface of the most likely location of an offender's residence (or some other anchor point associated with the offender), overlaid on street map of the area.

3.   Investigative strategies that geographic profiling can help inform

The results of a geographic profile can be used to inform a wide range of investigative strategies. The interpretation of the results of the geographic profile, alongside discussions between the analyst and investigators is what determines the type of investigative strategy to employ. Investigative strategies that geographic profiling results most commonly inform are:

- Suspect prioritization: narrowing down the list of suspects by identifying the neighborhood where the offender most probably lives, and reassess and re-prioritize suspects based on the cross-referencing of the geographic profile with a suspects list

- Analysis against known offender registries (e.g., criminal records, parole or prison records): this can help generate additional investigative leads from these recording

systems based on the results of the peak profile location, result in the police searching their own records of offenders to determine if the geographic features of these series match with those who were previously known to them, or help identity other crime that may be linked to the series, and the search of other systems such as vehicle license database (for suspect vehicle descriptions), and mental health records (if the offences exhibit mental health issues of the offender).

- Patrol saturation and operational stakeouts: in cases where the geographic profile may indicate where to direct saturation patrols and stakeouts (particularly effective if offences occur during specific times), where it is suspected that the offenders spends a significant amount of time searching for targets, or waiting for suitable victims and the right circumstances to commit a crime (i.e., providing the police with the opportunity to observe an offender prowling or loitering, rather than waiting for an assault to take place)

- Targeted police response plans: Many offenders return home after committing a crime. This knowledge can be used for deploy patrol units to the area of probable offender residence, or paying attention to the most logical routes from the crime site to the high profile area. Roadblocks may also be an option along the offenders probable escape routine. The approach can also help in suggest possibilities for locating witnesses (e.g., Petrol stations, cafes, bars and other services along the route)

- Public awareness campaigns: this can include the mailing of information about the offender to households and businesses within the peak area of the profile, for them to be alert and report any suspicious activity. This approach may, however, alert the offender that the police are attentive to the offender's movements and may result in the offender displacing their activities. This investigative tactic is most viable if the offender description information is sufficient and reliable

- Neighborhood canvasses by the police: in the area where the victim went missing, was abducted, attacked, or the body deposition location. This can include door to door canvassing, interviews, signs, and targeted media campaigns o the neighborhood

- DNA screening: DNA testing of all men or key suspects in the geographic profile peak area

4. An example of the use of geographic profiling – Operation Lynx

Operation Lynx was one of the largest police manhunts in the United Kingdom in recent decades. Between 1982 and 1995 three rapes, one attempted murder, four kidnappings, one serious sexual assault, one indecent assault and one other assault, all against women remained unsolved. The crimes were considered to be linked (committed by the same offender), even though they were committed over a large geographic area that covered the jurisdiction of three separate UK police forces. The police investigation had managed to collect DNA from one of the crime sites, and a partial fingerprint. Analysis of the DNA revealed it was not on the UK's national database, and the print fragment was too small to search using the UK's Automated Fingerprint Identification System.

An analysis of the offences suggested that the offender was likely to have a prior offending history of robbery from the person and/or fraud due to the violent way he initially behaved against his victims and the fact he would often steel credit and bank cards from his victims and use these to extract money from their accounts. This meant that the offender was likely to have had some previous contact with the police, but this information on its own was not that useful to the police. A sketch of the offender had also been drawn, based on information provided by one of the victims. Police investigation efforts were focused on suspects in the metropolitan area of the city of Leeds and its surrounding area due to this being where many of the offences took place. However, this was a large area, where the population was of several million people.

To help prioritise the suspect search strategy, the police decided to use geographic profiling, and to do so called on assistance from the UK's National Crime Agency. At the time, the police in the UK had never used geographic profiling, had begun to consider its use, and decided that Operation Lynx provided an ideal opportunity to evaluate its use. Figure 2a shows the geographic profile map that was produced, after an analysis of the crime series. In this example, the geographic spread of where the offences were committed meant that specific streets could not be identified, but instead geographic neighborhoods were identified. The dark orange, red areas in the map indicate where the offender was most

likely to reside, or anchor their activities, based on the geographic locations of where the offences took place.
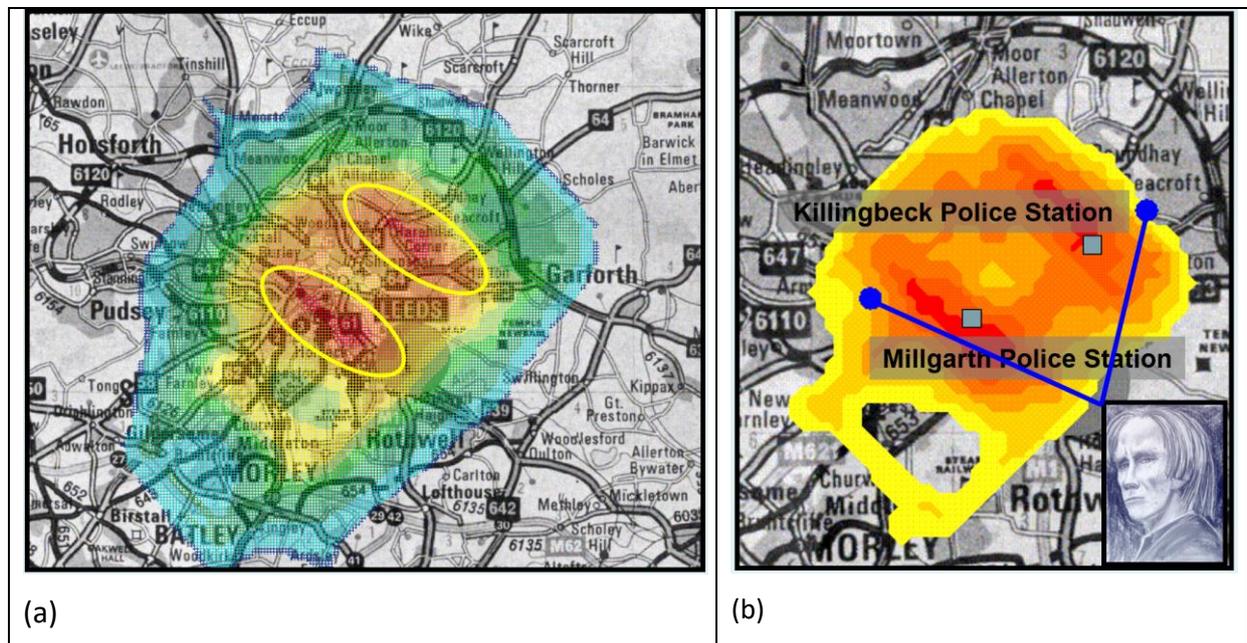

(a)

(b)

Figure 2. (a) the geographic profile produced for Operation Lynx, and (b) the location of the two police stations where records were searched and the two addresses where Clive Barwell lived during the period of time of the offending series.

This example is an illustration that the precision of the geographic profile is very much related to the geographic distribution of the offence sites. If the offence sites are very close together, individual streets or a collection of streets may be identified as the area of focus in a geographic profile map, but when the distribution of the offences covers a much wider area, the geographic profile is more likely to identify neighborhoods to target. In figure 2a two specific areas of Leeds were highlighted for attention. These 'peak profile' areas still covered reasonably large areas where many people lived, however, based on the hypothesis that the offender was probably known to the police due to previous criminal behaviour, the search strategy the police employed was to focus on examining the records of offenders that were stored in the two police stations that were located in the peak profile areas – Millgarth and Killingbeck police stations (see Figure 2b). This was on the basis that records for offences of fraud or robbery that were committed by the offender, and fingerprint records of the offender were likely to be stored in these two police stations more so than in

any other police station in Leeds. The search began, examining records of fingerprints from all robbery and fraud offenders against the single partial fingerprint that had been obtained from one of the crime scenes associated with Operation Lynx.

On the second day of the search (recall, the offences had been taking place for 13 years without any arrests being made), a match was made between the partial fingerprint and a crime record at Millgarth police station, identifying Clive Barwell as the suspect. Clive Barwell was arrested, his DNA was taken, and this was matched to the DNA of the offender from one of the rape offences. Clive Barwell was subsequently charged and convicted for these offences. Barwell had lived at two addresses over the duration of the crime series, with each address being close to the peak profile areas shown in Figure 2b.

This test case in the use of geographic profiling proved to the UK police authorities that it was a technique worth investigating in, which resulted in the UK National Crime Agency establishing a specialist geographic profiling unit consisting of four professionally trained geographic profilers to work on other cases of serial crime investigation, and other major crimes. Since Operation Lynx, geographic profiling has been used in the UK to support investigations associated with murder, other cases of rape, kidnapping, sexual assaults, house burglary, burglary of commercial premises, bank robbery, street robbery, criminal damage, arson, child abduction, metal theft, fuel theft, vehicle theft, assaults, missing people, border security and counter-terrorism.

5. Training program in geographic profiling analysis

There are two levels of training in geographic profiling – professional geographic profiler and geographic profiling analyst. Professional geographic profilers embark on a one-year training program and a one year mentoring program (provided by another professional geographic profiler). To become a professional geographic profiler involves detailed training in criminal behavioural psychology, mathematics and statistics, and environmental criminology, alongside extensive practical training, involving the visiting of many crime sites. Professional geographic profilers tend to be sworn officers working in large regional and national agencies (often with a criminal investigation background). Professional geographic

profilers are assigned to completing geographic profiles full-time and tend to focus their attention to supporting investigations of serious violent crimes such as murder and rape. There are less than 10 professional geographic profilers worldwide.

Geographic profiling analyst training program is aimed at crime/intelligence analysts working within a police agency, technically competent investigative officers and others working in applications where geographic profiling can be applied (e.g., military). Geographic profiling analyst are typically involved in completing geographic profiles on a part-time basis, in that they have many other analytical duties to perform other than geographic profiling. Geographic profiling analysts also tend to focus their attention to supporting investigations of non-serious violent crimes unless they are qualified to do so by the agency they represent.

The Geographic Profiling Analyst training program is designed to give police crime and intelligence analysts the background and skills required to develop and to interpret geographic profiles correctly, from which they can make actionable recommendations. Following the successful completion of the training program, analysts are awarded with an internationally recognised certification that in turn gives them license to apply geographic profiling analysis for the agency they work for. The Geographic Profiling Analyst training program course is primarily aimed at police crime/intelligence analysts, but can also be taken by researchers interested in applying geographic profiling for academic research purposes. Course attendees do not need to have any previous experience of geographic information systems or geographic analysis. Analysts from police agencies should ideally perform a role in their agency which would then take advantage of the skills they gained from attending this course. For example, analysts who are already involved in supporting criminal investigations would find this course of most benefit. The course includes training analysts in how they can use the results from a geographic profile to recommend investigative strategies.

The training program involves a two-week course of classes, workshops and computer-based exercises in which the theoretical principles underpinning the application of

geographic profiling are discussed. During the training course, analysts complete practical work involving real cases of serial crime to help them return to work with the confidence of applying geographic profiling to help support their agency's criminal investigations. Examinations are held at the end of week one and the end of week two to assess the student's progress. The week one exam is to initially test their knowledge on the key principles associated with geographic profiling to allow the trainer to identify areas that need further work in week two. The week two exam determines if the student can proceed towards full certification, by determining if the student has acquired the necessary skills that will enable them to complete an test operational report without any further guidance.

Within four months of the course, analysts must complete an operational report based on a real crime series of their choosing, and submit it to the course trainer to assess whether the analyst has reached the level required for certification. The trainer themselves must at the very least be a certified geographic profiling analyst, in most cases is a person who has worked closely with a professional geographic profiler, and has extensive experience of applying geographic profiling to a wide range of types of crime, and in a variety of settings.

This Geographic Profiling Analyst training course is run by UCL's Jill Dando Institute of Security and Crime Science in partnership with the UK National Crime Agency. Irvine Police Department in California, USA also run the same program annually in different parts of the United States. Computer-based exercises involve the use of the software CrimeStat and Rigel Analyst for the majority of software-based exercises. The training course also explores the use of Dragnet, R and centrographic spatial statistics for helping to generate geographic profiles. Attendees on the course receive free access to the Rigel Analyst software for four months after the course in order to allow them to complete their operational report.

Figure 3 lists the typical program for the two-week Geographic Profiling Analyst training course run by UCL. Each year the course undergoes some refinement and improvement based on feedback from course attendees, findings from new cases and research that have applied geographic profiling, and the inclusion of new investigative cases in the course program. The course includes:

- Skills development of the theoretical principles underpinning geographic profiling

- An examination of the geography of offending and offender mobility

- Lessons on crime linkage analysis

- Training on the ways in which geographic profiling can be used to determine the types of investigate strategies to employ

- Exercises and class discussions that aim to cement the skills that are required to successfully apply geographic profiling

- Computer-based training, using in most cases the professional geographic profiling software Rigel Analyst. Computer-based exercises make use of real world crime series to help analysts develop skills in a wide range of investigative scenarios, for different types of crime, and which lead to different types of recommendations on the investigative strategies to employ

- Training exercises that help analysts complete geographic analysis profile reports that are fit for purpose (e.g., that are useable by investigators), whilst retaining the standards to the typical content that a geographic profile report should include.

Week 1: class room based lectures and exercises

	Day 1: start at 13.30	Day 2	Day 3	Day 4	Day 5: finish at 13.00
9.30 10.15		**Theoretical principles (part 2)** • S4 Crime Pattern Theory (SC)	**The geography of offending (part 2)** • S10 Criminal hunting grounds (CJ)	**Crime linkage analysis** • S16 Crime series and linkage blindness (CJ)	• S21 Investigative strategies (SC)
11.00		**BREAK**	**BREAK**	**BREAK**	**BREAK**
11.15		• S5 Other key place-based behavioural principles (SC)	• S11 Search exercise (SC)	• S17 Crime linkage principles (CJ) • S18 Crime linkage variables (CJ)	• S22 Exam (SC)
12.00		• S6 Using problem-solving and hypothesis testing principles in geographic profiling (SC)		• S19 Crime linkage exercise (CJ)	
12.45		**LUNCH**	**LUNCH**	**LUNCH**	
13.30	• S1 Aims and introductions (SC)	• Video – Mapping Evil	• S12 Learning and displacement (CJ)	• S19 Crime linkage exercise and review (CJ and SC)	
14.15		**The geography of offending (part 1)** • S7 Crime location types (CJ)	• S13 Search exercise review (SC)		
15.00	**BREAK**	**BREAK**	**BREAK**	**BREAK**	
15.15	**Theoretical principles (pt 1)** • S2 Routine Activity Theory (SC)	• S8 Hunting methods (CJ)	• S14 Journey to crime and search behaviour (SC)	**Geographic profiling in practice** • S20 Geographic profiling case examples (CJ)	
16.00	• S3 Rational Choice Theory (SC)	• S9 Target backcloth (CJ)	• S15 Exercise – without a trace (SC)		
Eve	Course dinner				

Week 2: computer lab based, case work and scenarios. We will use CrimeStat and Rigel Analyst for the majority of software based exercises. Exercises will be based on real cases.

	Day 1	Day 2	Day 3	Day 4	Day 5: finish at 13.00
9.30		• S5 CGT assumptions and considerations	• S12 Poacher indicators	• S16 Exercise – Case 6 Jack the Ripper (part 1)	• S18 Course evaluation and discussion, and future support
10.15		• S6 Rigel Analyst – introduction • S7 Exercise - Case 1 Thefts from vehicles	• S13 Geoprofile report preparation • S14 – Case 4 Residential burglary (vehicle theft) (part 1)		
11.00		BREAK	BREAK	BREAK	BREAK (10.15)
11.15 12.00		• S8 Exercise - Case 2 Commercial robberies	• S14 – Case 4 Residential burglary (vehicle theft) (part 2)	• S16 Exercise – Case 6 Jack the Ripper (part 2)	• S19 Exam week 2
12.30	Day 1: start at 13.30	LUNCH	LUNCH	LUNCH	
14.00 14.15	• S1 Geographic profiling techniques • S2 Exercise – heauristics, centrography and probability surfaces	• S9 Weightings • S10 Exercise - personal activity space	• S15 Exercise – Case 5 Sexual assaults (part 1)	• S17 Exercise Case 7 Residential burglary (part 1)	
15.00	BREAK	BREAK	BREAK	BREAK	
15.15 16.00	• S3 Journey to crime estimation • S4 Exercise CrimeStat journey to crime estimation	• S11 Exercise – Case 3 Threatening letters	• S15 Exercise – Case 5 Sexual assaults (part 2)	• S17 Exercise Case 7 Residential burglary (part 2)	

Start time each day is 9.30am except Mondays. Finish time is 16.45 except Friday when it is 12.45

Figure 3. The certified Geographic Profiling Analyst two-week training program provided by UCL.

6. Developing geographic profiling skills in Mexico

6.1. Geographic profiling analysis training in Mexico

The geographic profiling analysis training course delivered in Mexico in 2018 was run by Dr Spencer Chainey, a certified Geographic Profiling Analyst with over ten years of international experience in its application. Twelve people attended the course, representing CNS and the Mexican Federal Police. Each had different areas of specialism, and were particularly interested in developing skills that would help them use geographic profiling to assist crimes of highway robbery, kidnapping, murder, and missing persons.

All twelve attendees completed the two-week training but only eight completed the second week exam to a satisfactory standard. The four that did not pass the exam were given feedback on why they had failed the exam, and given a second opportunity to conduct the exam. None of them took the exam at the second attempt. The eight attendees who passed the second week exam were then invited to complete an operational profile, which if completed to a satisfactory standard, would result in them receiving full certification. In each case, the trainer emphasized to each attendee that although they had passed the

second week exam, the content of the profile discussion in their report was quite brief and that this would need to be improved in the operational report. The following advice was given to each of the eight attendees:

I have attached your exam report and have also included as an attachment a copy of the exam report completed by a previous course attendee to illustrate some of the other things you should have considered in your report. Whilst I accept English is not your first language, you will need to significantly expand on your profile discussion in your operational report if you wish to be certified. I recommend you compare this example profile report I am providing to you against yours so you know some of the other things that are important to cover in future geographic profile reports.

Your profile discussion is one of the most vital parts of the geographic profile report. For future reports you should consider the following (whilst ensuring you are concise in your writing). You included some of these, but I provide them as a checklist for future reports:

- *Begin by providing a concise series description, including the modus operandi of the offender*
- *Discuss the scenario you decided on, but indicate if other scenarios produced similar or different peak profile results*
- *While you may decide to exclude certain sites for methodological reasons, discuss the value they offer in helping to interpret the crime series and support your geographic profile e.g., why would an offender return to a previous site/victimised target; what does a site that is close in space and/or time to another tell us about the offenders spatial behaviour; whilst a crime that is part of the series may be determined to be an outlier, does it's geography tell us something useful about the offender – could it indicate displacement from the rest of the series or was it committed due to opportunistic circumstances, and how could it feature in the offender's routine activities?*
- *Discuss your hypothesis/thinking about the series in terms of the following, ensuring that you do not just offer a descriptive narrative of the series, but instead provide some interpretation (i.e., offering reasons as to why the offender behaved in this particular way):*

- *Can the choice of sites be considered in terms of certain theoretical concepts e.g. Routine Activity Theory, Rational Choice, Crime Pattern Theory, victim backcloth/selection)?*
- *What's the offender's likely mode of travel?*
- *Do we have any clues about pre and post offence movement?*
- *What sort of knowledge would you expect the offender to have of the area?*
- *Does the time of day, day of week, or seasonality play a role in the series?*
- *Has there been an escalation of offending over the series?*
- *Consider the relationship between spatial and temporal patterns*
- *Are there any anomalies/outliers?*

- *It's useful to mention that while you believe the series to have been effectively linked, other offences and intelligence of interest relating to the series may not have been reported*

- *With regards to the commission of crime: were all the offences pre-planned, or were some purely opportunistic – interpret these differently in relation to the offender's spatio-temporal behaviour? What level of skill/knowledge was required to carry out the offences and is this reflected in the geographic and spatial features of the offence? What was the motivation? Does product disposal (e.g. intelligence or lack of product recovery) say anything about the spatial-temporal features of the series?*

- *Make sure your discussion is written in an interpretative tone, offering reasons as to why certain patterns are present, and why you think the offender (in a spatio-temporal sense) behaved in the manner he did (e.g. why did he wear a mask, why did he carry out a petrol drive-off offence, and what could this tell us about where he was likely to be taking the vehicle; why were offences carried out predominantly on Friday and mid-afternoon?)*

- *Discuss/consider alternative explanations other than your primary hypothesis and scenario. For example, if you considered removing the offence that took place on a Saturday whilst all others were weekday offences, describe how much this would have affected the geographic profile peak area (even if it did not change it at all)*

- *Suspects: make sure you treat this as a prioritisation process rather than completing discounting offenders who have a higher hit score.*

- *Investigative strategies: you should offer recommendations that are practical to implement, and show evidence/logic that you have considered some prioritising to these. Don't just offer a list of 101 things that could be done. Also consider opportunities that prevent future offences, such as raising public awareness about the series. While geographic profiling is primarily an investigative strategy, we should also consider its use for helping to prevent future crimes, rather than just letting more crimes occur to help further refine our geographic profile! Also, consider if there is any value in re-interviewing victims e.g. could this be useful to determine pre and post offence movement of the offender? You should involve investigating officers when it comes to deciding on investigative strategies, rather than just offer recommendations blindly*
- *Be careful to not fit/manipulate the profile to your hypothesis. It is worth considering that the strongest hypotheses are those that have the least amount of evidence that are NOT in support of it, rather than the one that has the most supporting evidence.*

To achieve full Geographic Profiling Analysis certification you must complete an operational report within four months of the course (deadline for submission is the 5 October 2018). The operational report should be completed following the report structure we discussed on the course, with emphasis towards writing a very good profile discussion.

Arrangements were made for the Mexican Federal Police and CNS to be granted a full trial version of Rigel for them to use until 5 October 2019 to help them complete the report and trial the software.

Only two people completed a full operational report. This was even when the deadline to submit reports was extended twice – on one occasion to February 2019 and on a second occasion to July 2019. In most part, the reason for all attendees to not complete an operational report was due to changes that occurred at CNS and in the Federal Police during this time. In November 2018 CNS was disbanded following the change in national government. This resulted in all members of CNS that had taken the course, leaving CNS and making it difficult for them to complete their operational report. Alternative arrangements were made for the analysts from CNS to gain access to Rigel and case information sourced

by the trainer were made available, but only 1 analyst from CNS completed an operational report by July 2019. During 2019, the Federal Police was subsumed within the new Mexico National Guard, and with this came the change in roles of those from the Federal Police who attended the geographic profiling training program. Only one person from the former Federal Police completed an operational geographic profile report.

The two analysts that completed operational reports did so to the required standard and have been certified as Geographic Profiling Analysts, but unfortunately both have since left the Federal Police and the Secretary of Security (that replaced CNS). This means that the police services in Mexico are still without certified geographic profiling analysts. Two of those that attended the training course (one of whom is certified) now works for CentroGeo in Mexico and are applying their geographic profiling skills in some of the work they do. This includes using geographic profiling to help research the disappearance of missing people. The analyst from the former CNS that became certified is now a PhD student at University College London, and is conducting research on the use of geographic profiling for improving the investigation of organised crime groups in Mexico (under the supervision of the geographic profiling training course trainer, Dr Spencer Chainey). More details on this research is provided in section 6.3.

6.2. Examples of geographic profiling from the operational reports completed by Mexican analysts

Only two analysts completed operational reports. As referred to earlier in this report only limited information can be provided on the content of the reports due their sensitive nature, and in one case the investigation being a current ongoing enquiry.

Case 1: A cold case – homicides of elderly women in Mexico City *(an edited extract from the operational profile report)*

This case examined a series of 41 homicides that have been linked and were carried out in Mexico City during the months of November 2002 and January 2006. All victims were single women and elderly. There was a very clear pattern in the occurrence of these murders - all incidents took place in the victim's home, and there were no signs that the doors had been

broken or forced. This indicated that the person committing the murders was invited into the victim's home. In the vast majority of cases, strangulation and beating were the causes of death. In most cases the house was searched by the offender because drawers and cupboards appeared to have been ransacked, and there were indications that money and jewelry had been stolen.

Declarations were taken from the victim's neighbors, describing a large person dressed as a nurse or social worker offering help to the elderly women who were the victims. Of note, was at the time (in March 2001) the Government of Mexico City began the Food Support, Medical Care and Free Drugs Program for adults over 70 years - an economic aid program for the elderly, which included the use of a card onto which money was deposited monthly for use in commercial stores or supermarkets. It is likely the suspect gained the trust of his victims by offering financial and / or medical help. The geographical areas where the crimes were reported were usually apartments and housing areas to the central zone of the city.

For the analysis of the scenario that was used to create the geographic profile map, 6 of the 41 cases were not included - the first because it dates from 1998 (a case that was a long time before the other offences), four others because it was not possible to get information om the precise location of where each crime took place, and one other that did not have information on the date of crime.

One hypothesis suggested that the offender finds his victims near hospitals and shopping centers, because for all the victims their homes were near to hospitals and supermarkets. It is then possible that the offender approaches the victim offering help to gain access to their homes. In some cases, the victims were found lying on their beds or found sat on a sofa or chair with bare feet, suggesting it was possible they were offered a foot massage. An alternative hypothesis was that the offender had accessed a list of names of elderly people requesting financial assistance from the government, and was using this as a means of targeting victims (rather than following them to their home).

The first registered homicide in the scenario that was used in the analysis was in November 2002. Over the entire series, November was the peak month for when these murders were committed against elderly women. Also, many homicides were committed during the summer months (June to August), but none were committed in the month of December. This was considered by the analyst to be due to the type of festivities during this month when it may be more difficult to find single elderly women because they are with their families more frequently, or the offender himself is busy with other duties.

Monthly behavior of homicides
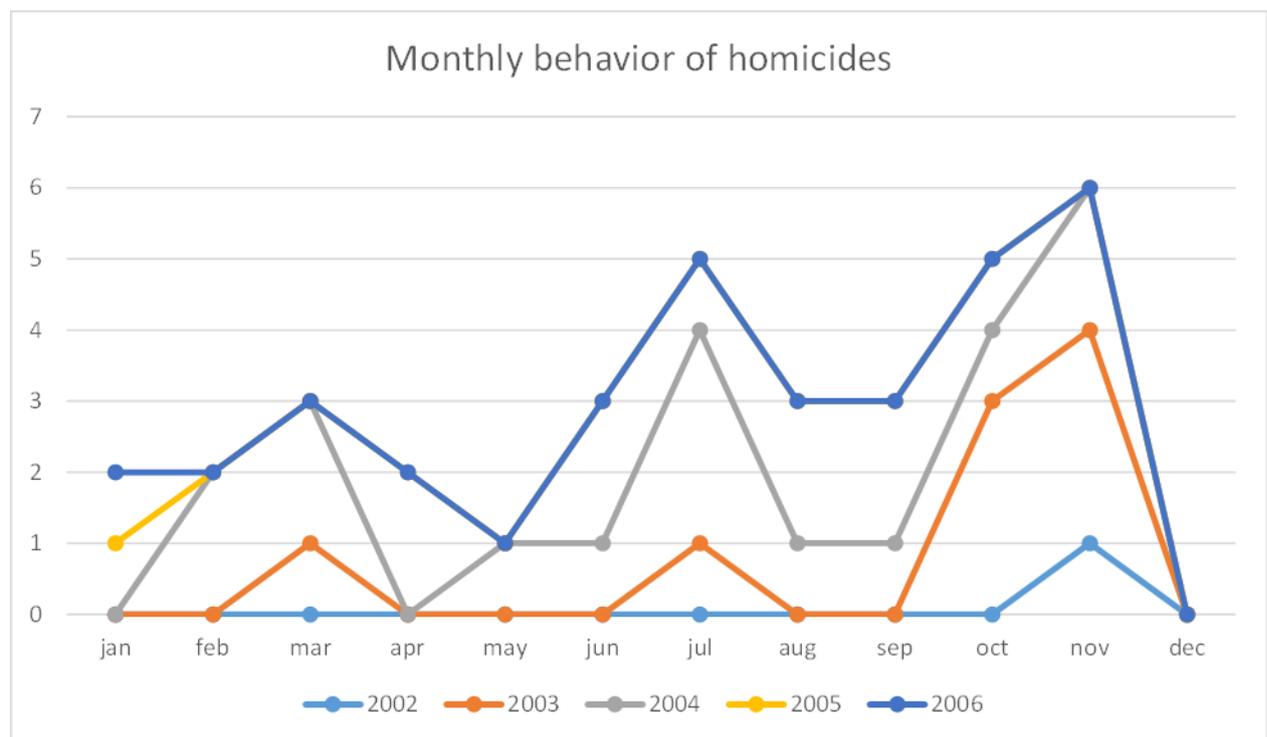
Homicides in the series were more frequent on Tuesdays, Wednesdays and Fridays, possibly due to the offender being more available to commit these offences on these days than on any others. This may be linked to his employment patterns. There was also a pattern in the hours in which the murderer attacked his victims, as most of the cases were recorded during the afternoon or in the hours before midnight. In relation to the cases in the afternoon, the analyst thought this may reinforce the hypothesis of the offender searching for victims outside hospitals and shopping centers or supermarkets, since it is the time of day when patients most leave the hospital and also the time when elderly women go out to buy groceries. In some cases, victims were found in their dining room with the food served on the table.
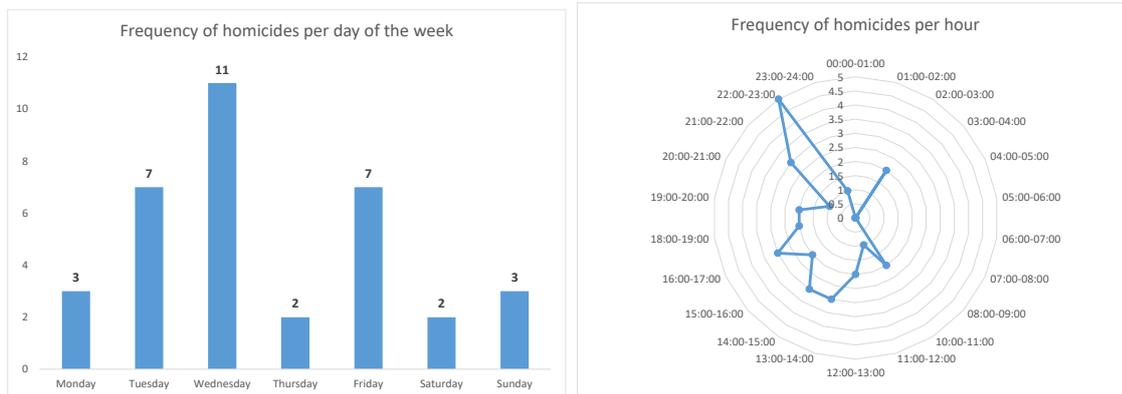
The offender is considered to have is hunting area in the central areas of Mexico City, in places where it is easier to move, and where public transport is more efficient. There were no homicide cases found on the edge of the city and in most of the cases, the victims lived in apartments and in central housing zones. In the few cases in which the offender returned to the same area to commit another crime, he may have already noticed the good opportunities in this area from seeing many other elderly and lonely women, or these areas provided an indication of where he is most close to – that is, it is an important area in his awareness space because he frequents it often, and this location is one of the easiest locations for him to get to because it is close to his home. It was suggested by the analyst that the offender was mainly using public transport, since it was easily accessible in these areas (trainers note: however, there was no clear evidence of this so it should not be considered important at this stage for informing investigative strategies).
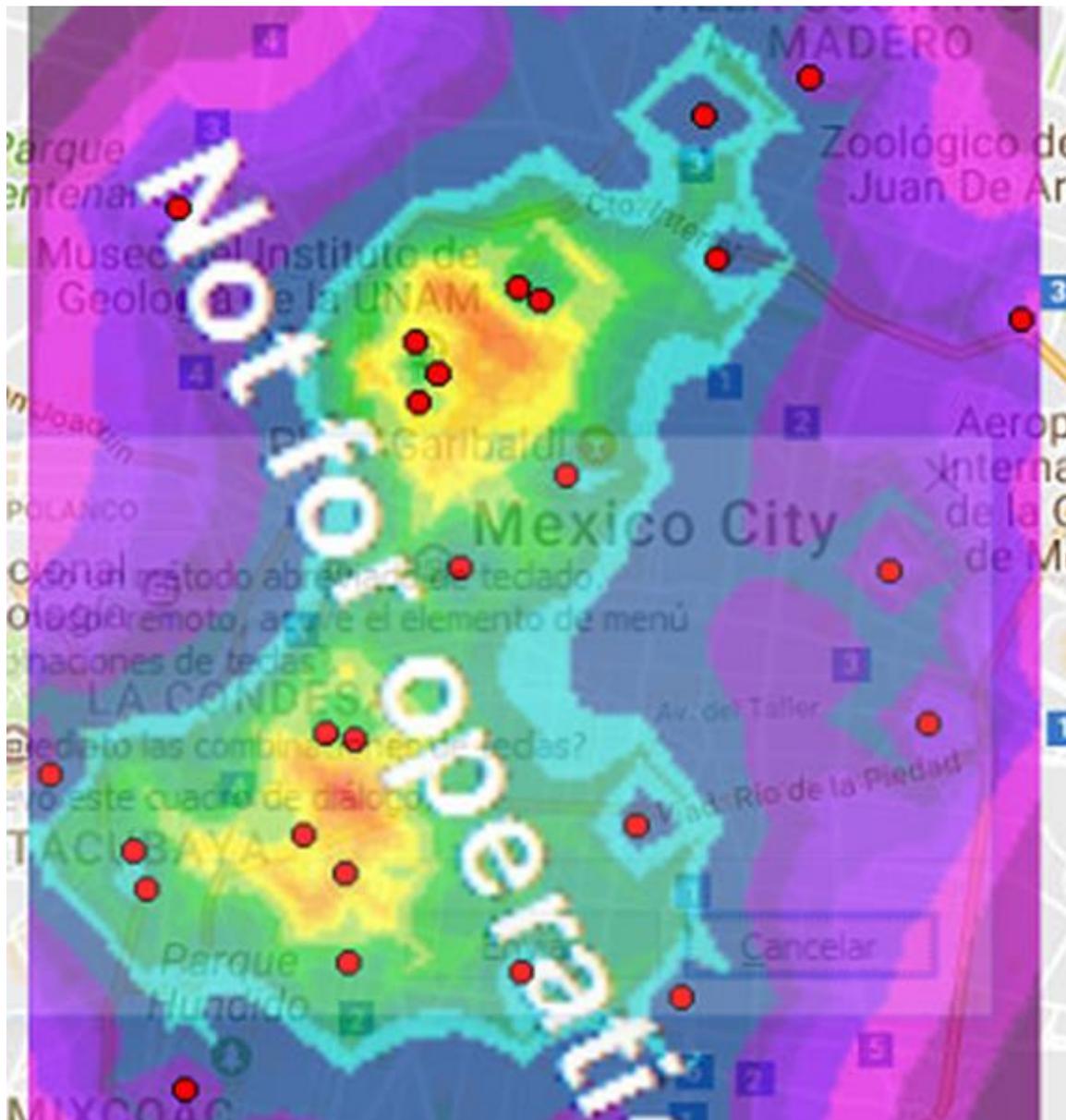
The geographic profile map generated from this case is shown above. More detailed maps were produced, but are too sensitive to include in this report. The map shows two clear peak profile areas relating to the geographic distribution of the offences – a peak that is north of the central area of Mexico City, and a second peak area to the southwest of the central area of the city. In this example, the analyst determined these to relate to probable areas of offender residence, being two different areas where the offender lived, or one relating to where he lived and one relating to another key anchor point such as a place of work. The main investigative strategy the analyst employed was to examine the home locations of suspects for these crimes and consider where they lived in relation to the peak

profile map. Of the four main suspects considered, one was discovered to have a major anchor in the peak profile located in the south west of the central city area. (for reasons of sensitivity we cannot disclose in public if this location was his home, place of work or some other key location). The home locations of the other three main suspects did not match in any way to the geographic patterning of where the offences had taken place. The result of the geographic profile has provided further evidence to support the claims that one of the four main suspects for this cold case is likely to be the person who committed these homicides.

Case 2: Robberies of cargo trucks on highways in Jalisco, Mexico (an edited extract from the operational profile report)

A geographic profile operational report was produced for a series of highway robberies that are considered to be linked and have occurred primarily on the federal highway 45 (segment between León, Guanajuato and Lagos de Moreno, Jalisco) during the months of January to April of 2018. In each case cargo trucks have been targeted. No consistent descriptions of the offenders have been provided, other than that in each case more than one offender was involved in the robbery. In all the cases, the offenders stole the truck with all the merchandise or products that were contained in the trucks. None of the stolen trucks have been recovered.

Cargo theft has become one of the crimes with most incidence in Mexico, and continues to increase. Mexico has a complex system of federal highways that cover 50,435 km. The Federal Police have a dedicated division of 15,000 officers for patrolling these highways. A provisional analysis showed that cargo theft is very concentrated to specific zones of the country, and in particular in Jalisco. Maps showing the concentration of cargo theft were produced for the report but are not available for public circulation.

Cargo thefts can account for a significant loss for the businesses it effects and is increasingly having an impact in the confidence of the public on the police. Also, it is believed that criminal groups are becoming more involved in this activity because of the large profits that

can be made from a crime that is considered to be of low risk to offenders. To help improve the highway patrol unit improve their understanding of the cargo theft problem, a geographic profiling analysis was conducted to determine if it revealed any patterns of use to support investigations and highway patrol deployment in Jalisco.

The geographic profile was based on a series involving 12 thefts occurring between the 03 January to 05 April of 2018. Analysis of these crime records revealed the paucity of information that was recorded by the police about the merchandise stolen, the time of day when the offence took place, details about the driver, and very little data about the offenders. In the first instance this has revealed issues with what is being recorded on these crime records and resulted in recommendations to the highway patrols on how this can be improved. However, good data on the location of the offences was recorded.

In each offence, more than one offender was involved in the criminal act. This creates a problem for geographic profiling – one of its key assumptions is that if there is more than one offender, the offenders reside together or in the same area. This is because the awareness space of two people can be different, but if they reside together (or close to each other), the peak profile is still likely to reveal the area where they both reside. However, if they do not live together or nearby, and offend only occasionally together, the peak profile may reveal an aggregation or average of their anchor points, rather than a specific location that is relevant to one or both. This challenge was considered throughout this case, and has in turn resulted in the formation of a new PhD research project conducted by the analyst that worked on this case.

Lagos de Moreno is a municipality located in the west of the country in a zone with high levels of industrial activity. In this sense, the area has a rich target backcloth consisting of many opportunities for this type of crime due to the large numbers of cargo trucks that travel on the highways in this municipality. The municipality is also considered to be a "highway hub" to some of the biggest cities in Mexico. In the area there is also a large

number of auto-parts markets (some of which are known to be illegal), easy connections with cities with high levels of consumption of electronic goods, clothes and food (two of the five biggest cities in the country are located within a 2 hours drive), and a high presence of criminal groups that are associated with the known drug trafficking in the area. Although the area is busy with industry, there are many sections of highway that are quiet during certain hours of the day (see pictures below).

It is believed, based on the data that were available, the two different groups are operating in the area, defined by the geographic locations of the criminal activity – a series in the north of the municipality and a separate series in the south. The geographic profile for this case was based on the 7 offences that took place in the north of the municipality. The main hypothesis relating to this series was that the single group operating in this area know the area very well, and have good contacts with the local stolen goods market. This means that for any items they steal, they can use their connections in the illegal market to dispose of the stolen items quickly, and also use these connections to dismantle the trucks into parts to avoid the trucks being discovered. In this criminal case, it was also considered that the result of the geographic profile may indicate a common hub for the offenders, with this

being the location where they were disposing of stolen goods, and not necessarily their home.

The offences that were considered for this series took place over a short period of approximately 16 weeks. Of note, 5 of the 7 offences took place on Tuesdays and Thursdays, with the other two taking place on a Wednesday and a Saturday. The segment of the highway where most offences were committed is located in the periphery of the city where there is a lot of commercial activity, with this highway connecting to other highways to major cities. Along this specific segment there are locations where trucks are required to slow down, or stop (see the picture below). These conditions may provide the means for offenders to identify opportunities for who to target, or may indeed help offenders commit their acts i.e., it is easier to stop a truck that has already stopped or is travelling slowly, than one that is travelling at speed.

The geographic profile map can not be shown in this report due to its sensitivity and its use in an ongoing highway police activity. However, what can be stated is that the geographic profile map identified a small area north of a major highway that is principally an industrial area. Whilst a geographic profile map is not an 'x' marks the spot routine, the areas that the map has identified is being targeted for the gathering of intelligence on illegal markets that may be operating in this area. In particular, the area that has been identified is thought to be where stolen items are taken after a cargo theft and also where the trucks themselves are broken down into parts.

6.3. Research – inspiring a hybrid crime script, social network and geographic profiling analytical approach to generate geographic intelligence for countering organised crime activity

The analysis of cargo truck robberies in Mexico and the potential use of geographic profiling for helping to investigate this crime has helped to initiate a new PhD research study at University College London. Geographic profiling has mainly be applied in the past to the offending of individuals rather than criminal groups. For criminal groups, each member may have a different awareness space, which in turn means that a geographic profiling analysis of the group may only reveal an average of their collective geographic behaviors rather than anything meaningful and specific about each individual that could aid their detection. Other analysis techniques, such as crime script analysis and social network analysis, are increasing being applied to better understand organised crime groups by examining the activities of individuals in the group, then seeing how these individual activities help to understand the function and behaviour of the group. In turn, these other techniques are showing promise in how the results they generate can then be used to counter the activities of organised crime groups.

Crime script analysis is a technique that helps to elicit greater clarity on offending behaviour, and the activities of interconnected participants (organisations and/or individuals) involved in illegal activity. As a result, crime script analysis can help build a picture of the decision-making of offenders by helping to uncover the influencing factors that may cause a particular behaviour or decision choice to occur. Crime script analysis involves attempting to describe the ways in which an offence unfolds and make explicit the series of decision-making points through which the offender passes in the process of crime commission. The construction of a description of a number of events into a structured sequence can then help to develop an understanding of the illegal activity. In this way, the technique is an attempt at answering questions relating to the skills that were required, the resources that were needed, the effort involved, and the people who are likely to be involved. For the purposes of understanding how criminal groups undertake the act of cargo theft on highways, and the people who are likely to be involved, crime script analysis provides a useful first step at helping to unpick the activities of the group into the activities performed by individuals in that group.

Chainey (2019). Introducing geographic profiling analysis in Mexico. UCL, Mexico CNS and IDB

Social network analysis (SNA) is the study of relationships between social entities. As a crime analysis technique, SNA helps identify the role of individuals in criminal networks (using statistical tools), and helps to determine the relative importance of these individuals within the structure of the broader organised crime network. In this manner, a SNA can draw from the results of a crime script analysis to identify who knows who within a criminal group, and how they are associated. In a hybrid crime script analysis and SNA form, this includes understanding the activities that people in the group perform, and how these activities are tied to geographic locations. This then means there is potential in applying geographic profiling to the results of a crime script and social network analysis that have helped to unpick the activities of individuals with the group, examine the locations that relate to the these activities, and consider what the results of a geographic profile analysis of these individual activities can reveal about the geographic behavior of the individual or the geography that is associated with the group. Such as, where these individuals reside and where they take stolen goods.

The research on this has begun in 2019. It is a PhD study meaning that the full results will not be published until after 2022, but we anticipate being able to publish some results as the research progresses.

7. Further information about geographic profiling

Further information about the application of geographic profiling can be read in a Wired magazine article that was published in 2014. The article draws from interviews with the inventor of geographic profiling, Kim Rossmo, professional geographic profilers workkng in national crime agencies, and Dr Spencer Chainey (UCL)

How geographic profiling helps find serial criminals

https://www.wired.co.uk/article/mapping-murder

More details about geographic profiling and its use in the case of the Zodiac Killer, a serial offender in the USA can be viewed in this video:

https://www.youtube.com/watch?v=fXbCR0nGj_E

Chainey (2019). Introducing geographic profiling analysis in Mexico. UCL, Mexico CNS and IDB

The definitive text book on the topic is 'Geographic Profiling' by Kim Rossmo, published in 2000

https://en.wikipedia.org/wiki/Kim_Rossmo

Further details about the certified geographic profiling training course can be found on UCL's website:

https://www.ucl.ac.uk/short-courses/search-courses/geographic-profiling-analysis-crime-and-security