English summary

Modus Via. Fine-tuning geographical offender profiling.

When an offender goes out to commit a crime, say a burglary, he needs a target location to commit that crime. The offender will most likely be somewhat familiar with the area in which he is committing his crime. And when he commits multiple crimes, becoming a serial offender his geographical pattern of crime locations is like a footprint of his behavior. Geographical offender profiling is an investigative method to predict to most likely anchor point of an offender based on an analysis of the geographical pattern of his crime locations. As such a geographical offender profile, a geographical indication of the anchor point, can possibly increase the efficiency of police investigations. By determining areas where the investigation might prove most fruitful in finding the offender, the police can deploy neighborhood canvasses, DNA-searches or database-inquiries efficiently by targeting a specific area.

Until now geographical offender profiling is predominantly developed as a spatial mathematical analysis. Discussions in the literature are focused on which mathematical function predicts most accurate based on the coordinates of the crime scene locations. As there has been little research in geographical offender profiling in using other information about a crime series than the geographical locations, for instance information about times when the crimes were committed , accessibility of the location or sequence of the crimes.

As an offender's geographical behavior entails more than just traveling to a location to commit his crime, his geographical behavior should get more attention during investigations. Especially when it can be assumed that some crime locations have a stronger geographical connection (i.e. are more close to) the offenders' anchor point. To have investigator focus more on the geographical behavior of an offender I introduce a new concept - modus via - to aid this. I define the modus via as the manner in which the offender is aware of and uses the environment when choosing his crime location and committing his crime. Modus via is similar to modus operandi but is specifically focused on the geographical characteristics of the offenders and his crime.

In this thesis I investigative if fine-tuning of geographical offender profiling with the modus via is possible. In the first chapter I introduce

geographical offender profiling, its theoretical background and the different studies of the thesis. For geographical offender profiling to work a number of assumptions and practical aspects must be met. The main assumption is that an offender commits crimes at locations that are geographically related to the anchor points in his routine activities as described in the Crime Pattern Theory. When an offender commits a series of crimes the end of his journeys-to-crimes the crime site will therefore be related to these anchor points. This makes it possible to relate the crime locations to an offender's anchor point. In order to be able to use a mathematical model to predict the offenders' anchor point it is helpful to have a series of crimes. In an ongoing investigation this means that it must be established which crimes are linked to one another and to the offender. Of those crimes the geographical location must be known in order to use the coordinates in the spatial analysis.

In the second chapter I describe the current mathematical methods of geographical offender in order to establish whether fine-tuning within and with those methods are possible. I distinguish the different geographical offender profiling methods in the way their outcome is created and presented. To characterize a geographical pattern of crimes one can use mathematical models that create a central tendency measure. The central tendency measures I describe are the average, median and centre of minimum distance (or least effort). To use these point predictions in police investigations it can be helpful if a search area around these points is created. In a study using solved burglaries committed by serial and non-serial burglars I analyze the possibility of creating individualized search circles around the point predictions. For each serial burglar separately an estimation of his criminal range – or journey-to-crime - is made based on the average distance between all his crime locations. That estimated range is then used as the radius of the search circle around his predicted – in this case the centre of minimum distance - anchor point. This seems a fruitful method of creating a predicted search area as close to seventy percent of the serial burglars are located accurately. Circles based on an estimated criminal range can also be used to geographically profile an offender in a different manner. In using a Venn diagram method circles are used to analyze the area of most overlap of the circles that are drawn around each crime location. To analyze its potential for fine-tuning geographical offender profiling I describe a case study of violent crimes against animals. The use of known travel distance of offenders, their

346

journey-to-crime, is the central element in geographical profiling approaches using a distance decay function. The distance decay approaches of geographical offender profiling as proposed by Rossmo, Canter and Levine are compared. Although the distance decay functions differ in general the approaches are very similar as they all have the same main assumption that the individual offender in the case under investigation behaves geographically similar to the aggregated group of offenders on which the distance decay function is based. To compare various methods of geographical offender profiling we conducted an experiment in which mathematical predictions are compared to the accuracy of humans when making either somewhat informed about the main principals of geographical profiling or non-informed predictions. The results of this experiment are that informed human are just as accurate (or inaccurate) as mathematical models. As I conclude at the end of this chapter fine-tuning geographical profiling is possible across all the different mathematical models by using a more refined approach of characterizing the pattern of crime locations than only on the basis of the coordinates. Each crime location can be assigned a weighting to increase or decrease it relative importance to the other crime locations.

Before discussing the manner in which and what kind of information should weigh in on determining the weights of the different crime locations in a series I analyze crime patterns and how offenders can be profiled in relation to the patterns they create. In the third chapter I describe Rossmo's and Canter and Larkins' typologies in order to investigate their potential in fine-tuning geographical offender profiling. As Rossmo's typology of serious sexual offenders is most detailed it is less clear in the manner in which an unknown offender can be characterized. Canter and Larkin distinction in offenders that commit their crimes in an area around their anchor point (called marauders) and those that travel to another area (commuters) is also not that clear, but is worth investigating as it is useful for geographical offender profiling. Simply put, if an offender is a marauder predicting his anchor point being his home can be done, if the offender is a commuter the predicted anchor be definition will not be his home location. For investigative purposes a geographical profile of a marauder will most likely much more useful that of a commuter. As for a commuter can have an anchor point within the predicted geographical profile but it can be almost any such as place of work, former place of work, home location of his partner or his favorite pub. In order to fine-tune

geographical profiling being able to distinguish if the offender of a unsolved series of crimes is a marauder of commuter is therefore an important question. In a large-scale study we researched the possibilities of predicting the offender travel type of property offenders using information that would generally be available in police investigations. As the results of this study show differences between marauding and commuting offenders is mostly gradual, no clear distinctive characteristics are found. Even though differences are only gradual they do improve prediction of offender travel type beyond change. Although being statistically significant in day to day practice it is still a caveat that an offender seems to be marauding but could be a commuter that is not recognized due to a different modus via.

      As the crime patterns of offenders are the consequence of decisions they make in choosing crime locations another approach to fine-tune geographical offender profiling is investigate the decision making process. If characteristics of crime location choice are observable (i.e. can be inferred without asking the offender) and stable, they can be used to assign weights to crime locations. I distil eleven factors from the literature that are assumed to influence crime location choice. These factors can be assigned to either the offender, the offender and the surrounding and the target and its surroundings. The factors are; preference, motivation, level of experience, level of planning, awareness space, routine activity area, perception of distance, mode of transport, time, absence of capable guardianship and target availability. The feasibility of using this factors as weighting factors is studied via an interview study with incarcerated offenders of property crimes and a case study of the TBS-file[45] of an offender of serious sexual offences. The results of the interviews make clear that most factors do influence the decision making of the offenders in most of their crimes. But it differs from crime to crime what factors are deemed important and how important they are in the decision to choose a location to commit a crime. Although this conclusions is relevant for theories of criminal decision making, as the factors are not stable across offenders one cannot create a standard set of weights to be assigned to crimes with those locations. The results of the case study are similar. The factors assumed to influence crime location choice can be described based on the file information but their respective weighting can only be assumed

---

[45] TBS is the abbreviation of ter beschikking stelling, which is the Dutch measure of incarcerating mentally ill offenders. TBS-files contain both court and psychiatric evaluation files.

instead of stated. At first glance these results would suggest that using specific factors to assign weights to crime locations is not a fruitful way of fine-tuning geographical offender profiling, but as the available investigative information differs between crimes in some cases the factors can be used.

In the fifth chapter I suggest how modus via can be used to fine-tune geographical offender profiling by assigning weights to crime locations that are assumed closer to the offender anchor point. As during an investigation it is not exactly clear which assumptions are correct I suggest the use of geographical scenario's to compensate for this. A geographical scenario is the description of one of the possible ways in which the assumed modus via of the offender has influenced the geographical pattern of his crimes. A geographical offender profile can now be created based on this geographical scenario and then compared with the geographical offender profile of another geographical scenario. For example if in a series of ten crimes three are committed in early in the morning and the others at night we can assume decisions to commit a crime were influenced by different aspects. One geographical scenario is this case is that the crimes committed in the morning are closer to the anchor point of the offender than the ones at night. The assumption in this scenario is that the offender does not travel a long distance early in the morning. The crimes that were committed in the morning should therefore get more weight in the geographical profiling analysis. The other scenario is that the night time crimes are closer to the offenders home. Assuming that the offender wants to come home as quickly as possible after a night time crime, or that using the cover of darkness he does not feel the need to travel that far to commit his crime unseen. In this scenario the nightly committed crimes will get more weight. As such two geographical scenario's can be investigated. The assigning of weights can be done based on either theoretical or empirical knowledge of offenders' modus via. Obviously this strongly relies on scientific knowledge and future research. Another approach to assigning weights is using investigators' knowledge about their local criminals and crimes, or specific case information. Although as I described earlier linked crimes are prerequisite for geographical offender profiling in the approach I suggest even crime linkage uncertainty can be used. By simply adding weight to the crimes in a series that are most linked and less to those that are not that clear one can investigative the effect on the geographical profile. One last approach to

assigning weights to crime locations is analyzing the pattern of the crimes and establish which crimes are outliers. Crimes can be outliers in different ways, most likely a crime will be an outlier in time or space. Those outlier crimes can, again, in one geographical scenario be assigned more weight as the one off location might be strongly linked to the offenders' anchor point, or less weight because it is an odd one out and therefore of less importance. Patterns of crimes can also reveal clusters of crimes, those crimes are close to each other. In the case study of the Utrechtse serial rapist we use the analysis of clusters to create a geographical scenario. In this case a number of clusters appear and our assumption is that the crimes in those cluster are not more important than the other crime locations. The conventional method of geographical profiling would use all crime locations in the analysis. As a result – due to the mathematics – the crimes in the clusters will influence the analysis strongly. We show that if we calculate the average location of the crimes within a cluster for all the clusters and then create a geographical offender profile the outcome differs strongly from the conventional method of geographical offender profiling.

The sixth chapter gives the overall conclusions of the possibilities of fine-tuning geographical offender profiling using the modus via. In this chapter I summarize the previous chapters and the results of the respective studies described. I conclude that geographical offender profiling can be refined by using other information than only the crime location coordinates. As the modus via, the geographical behavior of the offender, aids in describing different geographical scenario's it is helpful in creating refined geographical offender profiles that use as much investigative information as possible. Further research in collaboration with police investigators should be undertaken to establish if in practice a specific approach in assigning weights is more useful or applicable.