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CRIME MAPPING AND THE TRAINING NEEDS OF LAW ENFORCEMENT

ABSTRACT. This paper explores some of the more recent developments within crime mapping and the broader application of geographical information technology within law enforcement. The information technology (IT) revolution and the reduction in computing costs since the 1980s has brought a range of analytical tools within the budgets of most police services, and one of the most significant changes has been in the way that spatial data are handled. Law enforcement has strong geographic currents at all levels of the organisation, and this paper examines three applications of geographical information systems (GIS) within policing: hotspot mapping; CompStat; and geographic profiling. The paper concludes by discussing the future training needs using a simple model of intelligence-led crime reduction. This model suggests that training for managers to enable a greater understanding of the analyses presented to them, and how to use mapping to further crime prevention and reduction, may be as important as increasing the technical ability of crime analysts. The challenge for the immediate future of crime reduction practice in law enforcement is less to worry about the training of analysts, and more to address the inability of law enforcement management to understand and act on the crime analysis they are given.

KEY WORDS: CompStat, crime mapping, geographic profiling, GIS, police leadership, police management

INTRODUCTION

Since the mid-1980s, reductions in the cost of computing power and digital data storage have combined with a rationalisation of computer operating systems to enable the wide dissemination of a range of new technologies for crime fighting. With the computerisation of police records for statistical and managerial purposes came a realisation that these same records could be employed for crime and intelligence analysis, and in some cases crime mapping. Law enforcement interest in using geographical information systems (GIS) to map the incidence of crime occurred in parallel to research activities that identified patterns in crimes and criminal behaviour in the emerging field of environmental criminology (see, among others, Brantingham and Brantingham 1981; Bottoms and Wiles 1992; Rengert 1992; Bottoms and Wiles 2002). This development of practitioner interest in crime mapping alongside a research field dedicated to understanding the importance of place in offender behaviour and victimisation could be said to mimic and draw from a similar two-pronged thrust within geography. At the time, geographers were developing both GIS and geographical information science.

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This paper outlines the development of spatial systems and thinking, before proceeding to summarise activities in three areas of mapping that have become influential within law enforcement: hotspot mapping for crime analysis, CompStat mapping, and geographic profiling. The paper concludes by using a simple model of intelligence-led crime reduction to consider future training needs within the law enforcement arena, so that maximum benefit is derived from mapping technologies.

Spatial Systems and Spatial Science

Spatial analysis has for the last two decades or so been moving forward on two fronts; statistical spatial analysis and spatial modelling (Fischer et al. 1996). First there has been an increase in the development of statistical spatial tools, culminating in the recent development of geographically weighted regression techniques (Fotheringham et al. 2002). Secondly, and arguably more usefully for crime reduction planning and policy, there has been an expansion in the number of techniques available for exploratory spatial data analysis (ESDA), techniques that can be applied in a spatial modelling environment to reveal crime patterns and hotspots.

ESDA is an extension of exploratory data analysis (EDA), which is commonly used in a number of research fields. ESDA expands on EDA by explicitly examining and considering the spatial component of the data. Although most crime data could be considered to have a spatial aspect, ESDA explores patterns in the data from a predominantly geographic angle, such that other relationships between datum points are either of secondary consideration or are used to compliment and refine the spatial analysis. This is not to negate the value of other data variables within crime records: Other non-spatial features within crime records have been found to provide valuable insight into offender behaviour, especially temporal (Ratcliffe 2002) and modus operandi (Bennell and Canter 2002; Yokota and Watanabe 2002) variables. Within the data analysis phase of a study, ESDA promotes the spatial exploration to the forefront of the analysis, and with this increased interest have come a range of new and innovative spatial processes designed to uncover geographical patterns within data.

The development of many ESDA techniques from academic research interest into mainstream computer applications has enabled a cohort of criminal justice practitioners to uncover the patterns in their own data and drive new ways to view the criminal justice system, and in particular the law enforcement environment. This facet of geographical science can not be overstated enough – spatial analysis techniques are changing the way that many in criminal justice are doing business. Examples that will be discussed

in this paper include geographic profiling for serial crime investigations and middle management accountability processes for law enforcement, commonly known as CompStat meetings.

While one cohort of practitioners has embraced the new GIS technology and are starting to uncover the possibilities that emerge from the use of GIS, others have still to be exposed to the value of a spatial understanding of crime patterns. Some are reluctant to embrace the use of GIS within the organisational framework of the workplace, preferring to leave GIS outside the central sanctum of decision-making and policy formulation. Within many areas of policing, there is still in a failure to integrate spatial thinking into the core decision-making process at either a tactical or strategic level, even though GIS are currently being applied in many countries at a range of spatial and organisational levels. It has been argued by Stan Openshaw, a pioneer of spatial analysis, that although there are risks when a GIS is employed poorly to a policy situation, there is an equivalent 'crime' of not using GIS when it would enhance the policy decision (Openshaw 1993). For example purposes, the next sections will provide an overview of some key applications of GIS within the law enforcement environment. The paper then continues to discuss the future training needs of organisations so that an objective spatial understanding of crime can become more central to decision-making.

CRIME MAPPING

For at least the last 100 years police officers have stuck pins into paper maps displayed on walls, where each pin represented a crime location. In some places this practice continues. Although a pin in a map is certainly a 'crime map', this paper does not seek to refer to this technologically unsophisticated method of mapping crime as 'crime mapping', but reserves the term, and the following discussion, for the modern conjunction of two disciplines, crime research and geographical information science. The geographical community have for some time now utilised the abbreviation GIS for both geographical information systems and geographical information science (which is sometimes abbreviated as GISc). The distinction is relevant for this paper, as the former refers to a tool consisting of hardware, software, data, people and organizations for the collecting, storing, analysing and disseminating of information relating to the earth (Chrisman 2002: 12). For many practitioners this is realised in the form of a software package that sits on a desktop computer. The second description of GIS as a 'science' embodies the concept of a developing set of analytical processes, techniques and methods which advance spatial understanding. The development of crime mapping has required advances in both systems and the science.

In the early development of crime mapping, translating the systems from the specialist research area of geography to the practitioner environment of criminal justice practice caused some difficulties. The police were the first criminal justice agency to take a real interest in GIS, and remain the main supporters of crime mapping to this day. Early attempts at implementation were beset by technical issues and the incompatibility of police databases (Hirschfield et al. 1995), geocoding (the method by which a street address is converted into map coordinates) problems (Craglia et al. 2000) and management difficulties (Openshaw et al. 1990).

However once the early innovators had ironed out many of these technical difficulties, it was possible to expand the range of agencies that used computer mapping packages to map the instance of crime (Weisburd 2001). Much of this innovation was driven in the US by the Crime Mapping Research Center (CMRC), established in 1997 by the National Institute of Justice. Although a US agency, the influence of the CMRC extended beyond the continent and had a significant impact on the development of crime mapping systems in the UK, Australia and Europe. Now renamed the Mapping and Analysis for Public Safety program (www.ojp.usdoj.gov/nij/maps/), the NIJ program continues to provide free support and some software to law enforcement agencies experimenting with crime mapping, as well as provide grants that are strategically targeted to advance the field.

Crime mapping has therefore grown to be a significant player in the practitioner market: searching the National Criminal Justice Reference Service (www.ncjrs.org) for 'crime mapping' elicits over 100 hits, and on the popular search engine Google (www.google.com) the same search found over a quarter of a million hits (as of January 2004). For a recent history of crime mapping in the US, see LaVigne and Groff (2001), while a longer history of the field can be found in Weisburd and McEwen (1997).

Hotspot Mapping

Figure 1 shows an example of a rudimentary crime map, depicting vehicle crime locations in the US city of Philadelphia for July 2002. Automated pin mapping, such as can be found in Figure 1, provide a basic mechanism to convert a recorded crime database into spatial features (Harries 1999). The limitations of this rudimentary mechanism are well documented (Harries 1999; Ratcliffe 2001) and include problems of points that overlap, human inability to determine clusters, and the difficulty in establishing broad trends in point data. The problem of information overload and not being able to "see the wood for the trees" is evident in Figure 1. From a managerial perspective however, automated crime maps (like Figure 1) that could be easily updated and mapped using customisable search algorithms tailored to the specific request of the user, advanced crime analysis significantly

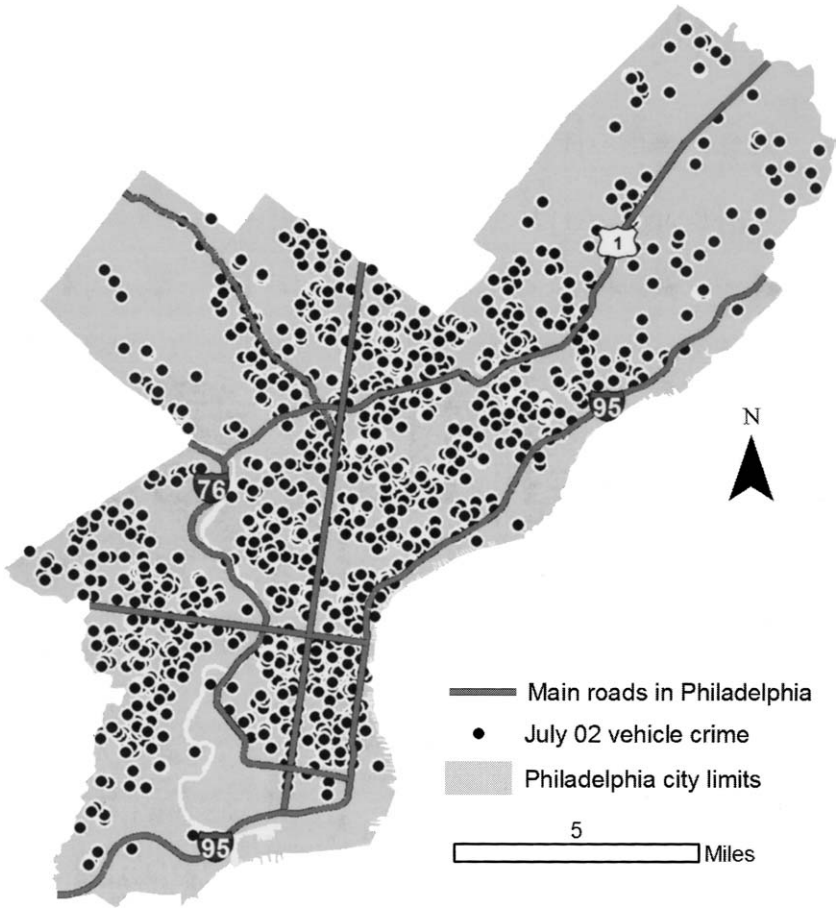

Figure 1. A basic 'pin' map of recorded vehicle crime locations in Philadelphia, Pennsylvania (USA) for July 2002. In the map, each crime location is represented by a small black dot. For US readers familiar with the city, the major interstate roads are indicated and labelled.

(Rich 1995). While the systems component of GIS has been advancing from a user perspective, the 'science' component has been advancing from the research direction.

The limitations of crime mapping and the difficulties with data overload as can be seen in Figure 1 have been overcome in recent years with exploratory data techniques such as kernel density smoothing (Gatrell and Dunn 1995; McLafferty et al. 2000) and cluster analysis (Ekblom 1988; Nelson et al. 2001). The same data for Figure 1 can be viewed using a kernel density surface that refines the display to emphasise the crime hotspots (Figure 2). From a law enforcement management perspective, this has significant value. Operational policing can be enhanced by concentrating

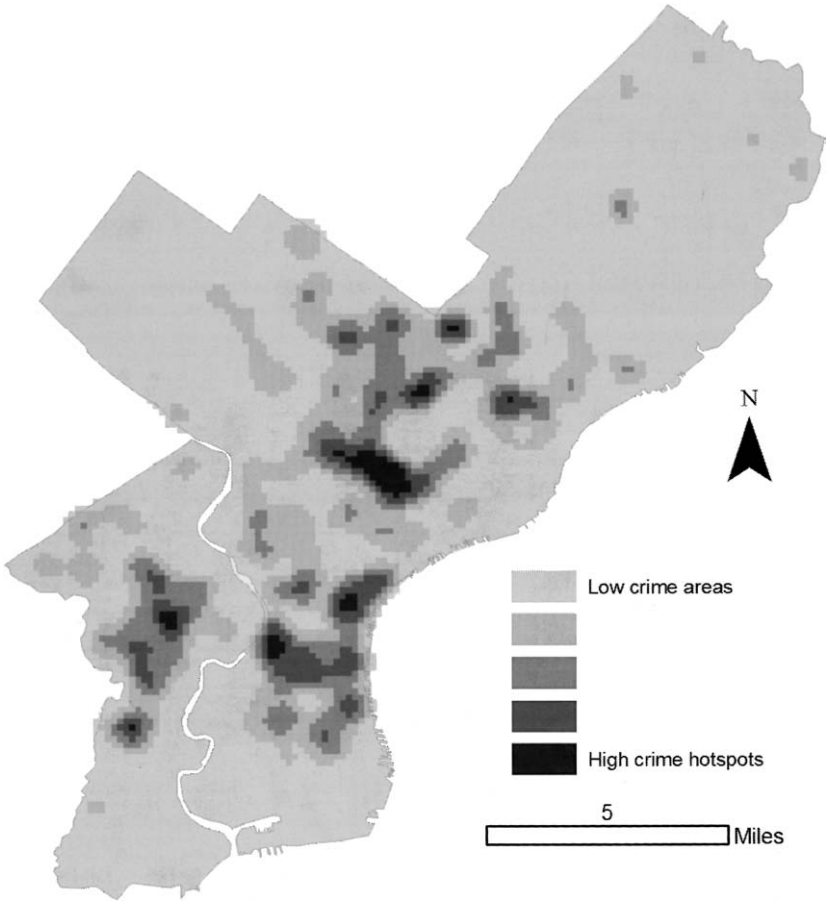

Figure 2. Same data source as Figure 1, except this time the points have been replaced by a kernel density surface which emphasises the crime hotspot locations at the expense of being able to determine individual crime locations. Although this could be considered a less accurate map, the image is still useful for police operational purposes and is also suitable for sharing with the public as it avoids identifying individual crime victims.

activity on crime hotspots, one of the areas where police can have a significant impact on crime (Weisburd et al. 1993; Weisburd and Green 1995; Sherman et al. 1998).

The improvements in GIS over the last 20 years have resulted in a situation where the desktop market is dominated by two commercial companies, MapInfo and ESRI (the most commonly used tools being the MapInfo suite of programs and ArcView and ArcGIS by ESRI). Although this does not negate the use of remote sensing applications and other programs for specialised law enforcement use (for example drug enforcement officers at national borders may monitor satellite imagery), the primary use of GIS in

the policing domain is in the area of property and violent crime mapping. While the market dominance of MapInfo and ESRI provides little advantage to users in terms of competition and pricing, the contraction of the field to two dominant systems had meant that developers seeking to advance the field of crime mapping have only to consider compatibility issues with two types of GIS structure. This rationalisation of the 'system' area of GIS has therefore enabled smaller developers and researchers to concentrate on advancing the 'science' aspect of GIS. As a result, advanced crime mappers in police departments across the world are able to map crime, disorder and calls for service, compare crime distributions to the underlying features of unemployment, race and other socio-economic data, and generate hotspot maps for intelligence use. As an example, Figure 2 shows the same data as Figure 1, except that the data has been run through a hotspot algorithm using a software program called HotSpot Detective™. This program applies a particular range of spatial and temporal algorithms to crime data, but a more complete review of spatio-temporal crime analysis routines, with an application, can be found in Ratcliffe (2004a). In Figure 2, the computer program generates a hotspot surface map showing the hotspots of crime without having the distraction of hundreds of individual points.

Hotspots have taken on a significant prominence in policing in a number of countries. For example, the evaluation of a range of crime prevention measures by Sherman and co-workers found that concentrated hotspot policing was one of the few policing activities that could demonstrate measurable long-term crime prevention and reduction (Sherman et al. 1998). In the UK, hotspot crime and disorder problems are one of the four tactical problems that are deemed important enough to tackle within the framework of the National Intelligence Model (NCIS 2000; Flood 2004). Hotspot mapping technologies have advanced rapidly and are now one of the central features of CrimeStat, a publicly available and free software package supported by the US National Institute of Justice.

Mapping technologies similar to this have been used within the criminal justice system to map a wide variety of crime-related phenomena, including temporal patterns of high volume crime in Sydney, Australia (Ratcliffe 2002) and city crime patterns for operational management and CompStat purposes (McGuire 2000). Indeed CompStat, in its many forms, has been one of the main driving forces in advancing law enforcement use of crime mapping and is discussed in the following section.

CompStat

CompStat (abbreviated from Computer Statistics) rose to prominence in the New York City Police Department (NYPD) in the early 1990s, where precinct captains were presented with maps of crime distribution at regular

meetings, and were required to respond to local crime patterns and reduce the crime level. CompStat has been described as a "goal-oriented strategic management process that uses computer technology, operational strategy, and managerial accountability to structure the manner in which a police department provides crime-control services" (Walsh 2001: 347). CompStat is not a crime mapping method *per se*, but it is a significant application area for crime mapping techniques and conference presentations often discuss the best way to integrate crime mapping into the CompStat meeting format. Although the whole CompStat process is one of managerial accountability, crime mapping became the central pillar and medium through which a room full of senior police officers could observe the effectiveness (or not!) of a police commander. Now widely adopted throughout the USA and beyond, CompStat has been described as a paradigm shift in operational policing. This is probably the case, introduced as it was into a police culture that was (and still is in the majority of places) fixated with internal rules, managerial procedures and local efficiency rather than any external indication of police effectiveness (Goldstein 1990).

The CompStat model has travelled far and wide. At the 2003 meeting of the International Association of Chiefs of Police (IACP), the Philadelphia Police Department (USA) shared a platform with the Thames Valley Police (UK) in a session that explored how the Philadelphia model had been translated to the British context. Furthermore, the New South Wales Police Service (Australia) equivalent has been thoroughly evaluated for its crime reduction effect. Termed an Operations and Crime Review (OCR), the New South Wales model works in a similar vein to that in New York City. In a large meeting room with up to 100 police officers, a number of different local area commands are brought to the fore and presented with the patterns of crime since their last attendance at an OCR, a period of about three months. The local area commander is then required to explain what major crime patterns have occurred since his or her last attendance, and the activity that police are currently undertaking. Most importantly, the local area commander is required to explain what they will do over the next three months to combat the crime problems that are displayed on three large screens in the room. Notes are taken for review at the commencement of the next meeting attended by representatives of that local area command. The strength of the process lies in the rapid conversion of crime data into map-ready form enabling a large audience to quickly determine the location of crime hotspots.

Problems with CompStat lie less with the mapping component than with the organisational element. CompStat requires flexible leadership from operational commanders, a knowledge of 'what works' and 'what is promising' in policing tactics, as well as the bravery to experiment with different crime reduction strategies in a live operational context. As Walsh is right to

point out, "this process of operational experimentation is challenging the core beliefs and attitudes of many police managers about what constitutes effective policing" (Walsh 2001: 348). The main problem with CompStat is that it challenges police managers in areas in which they have never been required to be effective. Few police commanders have ever been trained in crime reduction or how to interpret criminal intelligence analysis products such as crime maps. This situation is analogous to teaching a group of students mathematics and then setting a test on English literature. In other words, the criteria used to determine suitability for promotion within contemporary law enforcement rarely include knowledge and ability to effect long term crime reduction, yet this is exactly the skill that CompStat demands. Only recently have crime reduction measures been used as a performance indicator, and the rest of the policing management system has yet to catch up to this new paradigm.

Geographic Profiling

While CompStat is an operational management process, geographic profiling is an investigative methodology. Geographic profiling is an investigative technique designed to aid police investigations into serial crimes. In essence it aims to provide a spatial profile of a possible offender in rather the same manner as a psychological profile. While a psychological report can provide some clues as to the mental state and demographic characteristics of an offender, a geographic profile can suggest areas where the offender might live or work. The field of geographic profiling has grown from the innovative combination of a number of spatial theoretical concepts, the most significant being environmental criminology (Brantingham and Brantingham 1981). The Brantinghams' crime pattern theory provides a framework for offender search patterns in their hunt for crime opportunities, and is itself derived from a combination of routine activity theory (Cohen and Felson 1979; Brantingham and Brantingham 1993) and opportunity theory (Jeffery and Zahm 1993), also known as the rational choice perspective (Cornish and Clarke 1986; Clarke and Felson 1993; Newman 1997).

These theories state that most people will develop a routine activity to their lives such that they will go from home to work at around a certain time, travel from work to recreation activities, and then from the recreational activities to home. This is of course hugely simplistic, but the broader concept is that people develop certain places that they commonly frequent (such as home, work, school, restaurants, bars, movie theatres and so on). These *nodes* become comfortable places which feel secure and where people spend a considerable amount of time. The *paths* that run from node to node are also areas where people feel comfortable and relatively secure, due to the feeling of being in familiar circumstances. The Brantinghams' argue

that offenders will have similar routine activities in their lives, but these areas of familiarity will also be the search areas for opportunities to offend. While Cohen and Felson's Routine Activity Theory can be interpreted as an indication of victim behaviour (Robinson 1999), crime pattern theory can be considered the offender equivalent (Brantingham and Brantingham 1993), indicating areas of likely criminal behaviour. At the coming together of the victim and the offender is a rational choice by the offender to take advantage (or not) of any criminal opportunity that is presented (Cornish and Clarke 1986; Clarke and Felson 1993).

Geographic profiling pulls these ideas together to deconstruct a pattern of offending elicited from victim information and crime scene examination resulting in a map of crime sites such that each point represents a location where the offender was known to be, at one point in time. Knowledge of journey-to-crime research assists in the interpretation. Journey-to-crime research builds on the least effort principle which states that most people will not travel further than necessary to achieve a goal. For example, few people will travel from one town to another in order to buy bread as this common commodity can usually be purchased close to home. Offenders similarly rarely travel further than necessary to commit crime, as increased distance requires additional effort and increases risk. Offenders therefore search closer to home for criminal opportunities, and usually within their routine activity or *awareness* space.

From the crime site clues and with extensive knowledge of general offender behaviour, a process known as aggregate criminal spatial behaviour (Brantingham and Brantingham 1984), geographic profiling can estimate the likelihood that a key *node* for the offender is in a certain area. The eventual output from the computerised spatial analysis routine is a surface map of risk which identifies the likelihood of residence of the offender by area. Areas that have a higher likelihood of offender residence are more likely to have either a home or workplace of the offender in those areas.

The application possibilities for geographic profiling are substantial. Given that a rudimentary geographic profile can be constructed for a crime pattern based on as little as six offence sites (Rossmo 1995a), the process can be used on a number of different crime types. Geographic profiling can be used for suspect prioritisation, patrol saturation, enhancements to police information systems, linking with an outside agency database, and most recently to target DNA testing of large populations. The process has been mainly used for serial homicide and arson investigations (Canter and Larkin 1993; Rossmo 1995b; Rossmo 1997; Canter et al. 2000; Rossmo 2000) but the processes of journey-to-crime research and geographic profiling have also been applied to residential burglary studies (Barker 2000; Wiles and Costello 2000), and could theoretically be used for most crime types that have an outdoor opportunity structure (such as vehicle theft and

robbery). Geographic profiles have been provided by investigators trained by Environmental Criminology Research Inc (www.ecricanada.com) on a variety of high profile cases, including the Washington sniper investigation, where Professor Kim Rossmo was invited to provide a geographic profile as an investigative aid.

While the techniques of geographic profiling are still being refined, and some studies suggest that the technique has limitations for some offender types (Santtila et al. 2003), the research aspect of this field is growing, providing new cases to act as test beds for technique adaptation. Rossmo claims a high success rate for geographic profiling (Rossmo 2000) and ongoing work by the UK Home Office is currently exploring the socio-economic applications of the geographic profiling methodology as a possible apparatus to establish a more strategic understanding of offender behaviour in space.

Moving Forward with GIS

The range of spatial analytical options that have opened up for crime analysts over recent years clearly has training implications for the criminal justice system. Police crime analysts in particular are often under pressure to be not only familiar with the latest techniques but also how to apply those techniques in an practical crime analysis situation. As with any developing field, the route to an established analytical regime is paved with many dead ends or techniques that are only in vogue for a few years and are quickly superseded by superior methods. One example is STAC, a program for the spatial and temporal analysis of crime (ICJIA 1996). Although popular in the United States for a number of years as a hotspot surface mapping tool, the methodology has been found to be arbitrary and unsuitable by a number of researchers (Bowers and Hirschfield 1999; Ratcliffe and McCullagh 1999; Craglia et al. 2000). The real strength of STAC was to provide a starting point for the development of more powerful techniques, and to establish the need for such tools within the research and practitioner community. In this latter role, STAC established itself as a pioneering technique within the field of spatial crime analysis.

It would be natural, given the rapid development of spatial crime analysis as a field, that the major cause of concern would be the establishment of training regimes for crime analysts. After all, the plethora of appropriate techniques that add value to crime information (some of which are described earlier in this paper) would suggest that the training of analysts is a fundamental issue, and in many cases this is true. However there is another, more pressing training concern that becomes apparent when we use a simple model of intelligence-led crime reduction to explore the broader picture of crime control.

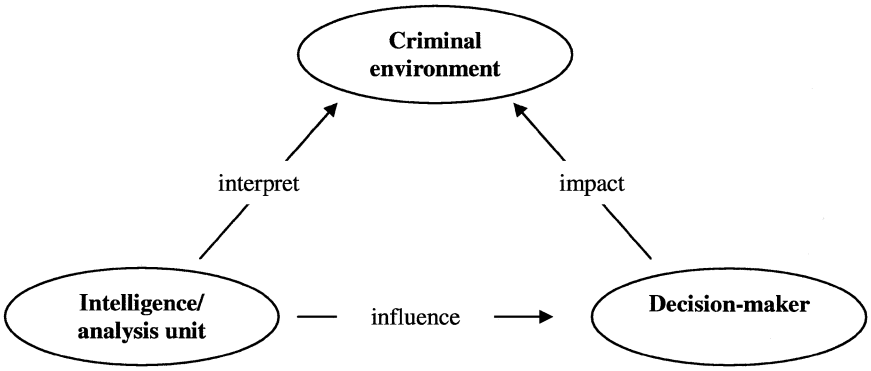

Figure 3. A model of intelligence-led crime reduction. *Source*: Ratcliffe, 2003.

This model of crime control, from Ratcliffe (2003), is shown in Figure 3. In this model, the role of the intelligence unit (the usual home of the police crime analyst) is to interpret the criminal environment. It is in this role that spatial crime analysis techniques are applied to crime data in order to ascertain a picture of the crime situation. The importance of this analytical role can not be underestimated within the framework of intelligence-led policing. For example, the UK National Intelligence Model focuses on only four analytical situations, one of which is the identification of crime and disorder hotspots of which crime mapping is an essential technique (NCIS 2000). However the identification of crime hotspots is not the end of the story. As can be seen in Figure 3, this new intelligence has to be communicated to a decision-maker, someone who is either within the police service or in a relevant crime prevention arena. The intelligence gathered from the analysis (spatial and aspatial) must be used to influence the thinking of the decision-maker. Without the ability to communicate intelligence to decision-makers, analysts will find that their role achieves little and has no impact on the criminal environment.

The final stage of the model (Figure 3) requires the decision-maker to use the intelligence provided by the analyst to influence their choice of crime reduction and prevention strategy so that an effective crime reduction regime can be implemented. Only if this final stage of 'impact' occurs will the intelligence-led crime reduction process be complete. The overall model places equal significance on the ability of the intelligence analyst to interpret the criminal environment as it does the need for the decision-maker to influence it. With this model there are therefore three areas of training attention. One places a responsibility on the analyst, in that the analyst has to be able to interpret the criminal environment. The influence arm of the model places equal weight on the analyst and the decision-maker, in that the former has to explain the criminal intelligence and the

latter has to understand the intelligence. The final arm of the model places the responsibility squarely on the shoulders of decision-makers.

Where Are the Training Needs?

From this observer's perspective, it would seem that the crime analysis field is making more progress in training and education of crime analysts than general policing has made in the police leadership arena. At the time of writing, the International Association of Crime Analysts are finalising a certification programme, complete with a training handbook and pre-packaged classes, which has a complete area dedicated to spatial analysis techniques (details of the new training programme can be found at www.iaca.net). Similarly, the International Association of Law Enforcement Intelligence Analysts (IALEIA) advertises dedicated crime mapping training sessions through its web site (www.ialeia.org).

A number of police services throughout the world also offer their officers dedicated mapping training. For example, the New South Wales Police Service, Australia's largest, has offered dedicated crime mapping training to all of its crime analysts for many years, and the New Zealand Police have mapping training for their Intranet mapping service, the Map-based Analytical Policing System (NZP 2002). The New York City Police Department use mapping as the information basis for their CompStat process (McGuire 2000), and this is mimicked in the New South Wales Police Service equivalent, the OCR (Chilvers and Weatherburn 2001). The Metropolitan Police (UK), one of Europe's largest police services, has also had an analyst training programme that sets aside significant portions of the programme to spatial analysis. The desire to professionalize and provide analytical utility is therefore driving the law enforcement crime analysis field to train itself in spatial crime analysis.

The second stage of the model in Figure 3 is to use crime analysis intelligence to influence decision-makers. Within a law enforcement environment it is usual that the initial decision-maker is a local commander. It is at this point that questions arise as to the state of the police leadership field in regard to understanding intelligence and acting on crime analysis information. As an indication, consider the training catalogue of the International Association of Chiefs of Police (IACP). The 2004 catalogue lists all of the programs offered across the US (www.iacp.org/training/2004IACPTrainingCatalog.pdf). The IACP offered 68 different programs throughout 2004 in the US, organised into categories. The main categories of program are itemised in Table I.

None of the 'Quality Leadership' line of programs offer courses on crime prevention or reduction and none of the leadership programs address crime reduction or prevention as sub themes. Only one of the 68 programs

TABLE I

Main categories of programs offered in the 2004 IACP training catalogue.

Program category	Number of courses offered
Quality leadership	5
Community involvement	8
Management and supervision	12
Crisis management	3
Force management and integrity issues	8
Staffing, personnel and legal issues	9
Patrol operations and tactical responses	13
Investigations	10

explicitly addresses problem-oriented policing, intelligence-led policing or general crime prevention and reduction. The Initiating Preventive Policing program is a 2-day course offered twice in 2004. There are a small number of programs that also address crime reduction, though only in specific situations[1]; Reducing School Violence (a two-day program offered three times); Civil Remedies for Nuisance Abatement (a two-day program offered once); and, Preventing and Reducing Elderly Victimization (a two-day program offered twice throughout the year). There are two courses that are pitched at crime analysts: a three-day introduction course (offered twice) and a single three-day advanced class.

Therefore in summary, the training regime offered to police in the US by the leading police chiefs organisation only has one of 68 programs dedicated to general crime prevention, and only three courses that address crime reduction in specific situations. These programs total 16 days of training offered. By comparison, the number of training days dedicated to SWAT tactics and management is 48.

This is not intended as a direct criticism of the IACP. On the contrary – they provide a wide range of programs that are essential to the general management of a local police service as well as a suite of courses that address specific needs. They rely on feedback from their clients as to the training needs of the law enforcement population. It does however indicate that from the training programme there is a sense that police leadership (in the US at least) does not perceive that it should be aware of the new processes within crime analysis, nor of how to apply criminal intelligence and crime analysis to crime reduction or problem solving. There

[1] The Enhancing Community Policing with the Media class mentions crime reduction but only in connection with the management of the media.

is no specific training in long-term crime reduction philosophies such as intelligence-led policing or problem-oriented policing.

This is not to say that problem-oriented policing or intelligence-led policing are not popular and supported. In the UK, there is, among some commentators, a desire to see the National Intelligence Model integrate the dominant policing strategy – intelligence-led policing – with the more globally recognised problem-oriented policing (Tilley 2003), and in the US, Scott remains cautiously optimistic in regard to the future of problem-oriented policing, twenty years after its inception (Scott 2000). Although disconcerting to some observers (Whyte 2003) GIS is playing a central role in the Crime and Disorder Audits that have become mandatory in the UK as a result of the Crime and Disorder Act 1998.

Both intelligence-led policing and problem-oriented policing demand high quality information and intelligence analysis so that tactics can be accurately targeted to the right place in a timely manner. In this demand for quality analysis, they do not differ. This broadband recognition that quality crime analysis is the bedrock of any modern crime reduction strategy is driving the crime analysis field to respond and the future seems bright for the quality of crime analysis. The difficulty stems from the lag in training managers to understand and apply the intelligence and analysis that they are presented with.

Training for police managers is a complicated process because they rarely have much free time, and the available space within their training regimes for crime reduction is even more limited. There appears to be an implicit assumption that as senior officers have risen through the ranks of the police service, they have absorbed all they need to know about crime reduction. It would appear that there is a notion that just by being in the police for some time they must know how to 'do' crime reduction. The corollary of this is that there is therefore no real perceived need to teach crime reduction or prevention, as evidenced by Table I. This would appear to be a mistake, as there is evidence that intelligence analysis is still required to 'convince' management of its value (McDowell 1998; Gill 2000; HMIC 2001; Ratcliffe 2004b). This is not to negate the value of training managers in business planning, budgets and personnel issues. However, crime prevention remains the core business of the police and this has not changed since 1829 (Mayne 1829).

Conclusion

The broader area of crime mapping would appear to either be, or on the verge of becoming, a fundamental tool in the criminal justice system and in law enforcement in particular. Specific methodologies such as spatio-temporal mapping and geographic profiling provide practitioners

with analytical tools that were not previously available without considerable effort. Practitioners (and a few academics) in the fields of crime analysis and intelligence have been quick to realise the training requirements and have been gearing their respective organisations to provide the necessary instruction so that the analytical benefit of the new spatial technologies can be realised. However, the much wider field of police leadership and management has yet to fully embrace the changes that have been happening within the field of crime analysis, leaving a knowledge gap between crime analysts and law enforcement managers. However advanced crime analysis becomes, unless it has the capacity to influence decision-making and thinking at the levels that can actually drive positive change in the criminal environment and the crime level, then all the advances in geographic information systems and science will show little investment return.

While crime analysis still has a long way to go, it is moving ahead at a quick rate and growing in significance. However the opportunities presented by techniques that have been available for some time do not yet appear to be on the radar of police managers. GIS is yet to be fully established as a central player in the criminal justice system but the long term future would appear to be fairly positive if the current paradigms of intelligence-led policing and problem-oriented policing remain at the forefront of police thinking. If police management training can embrace the benefits of these new ideas, from a crime analyst's perspective, there may indeed be a light at the end of the tunnel, and for once it might not be a train coming the other way. The challenge for the immediate future of crime reduction is less to worry about the training of analysts and more to address the inability of law enforcement management to understand and act on the crime analysis they are given.

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