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CHASING GHOSTS?

Police Perception of High Crime Areas

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In recent years there has been a move within police services towards a proactive and intelligence-led style of policing. This has coincided with a recognition of the value of local policing solutions and the importance of the intelligence function at the local area command level. This paper uses a combination of hotspot analysis within a geographical information system (GIS), a hotspot perception survey of police officers, and small focus groups to assess the intelligence dissemination process for high volume crime on three Nottinghamshire subdivisions. The results indicate a variable result depending on crime type explored and the study has implications for the dissemination of high volume crime intelligence within police services.

There has been a recent move both within British policing and beyond towards a more decentralized, proactive style of policing. This has shifted the emphasis for intelligence analysis and dissemination on to officers and analysts at the local area command level. The intelligence officer at a divisional station is now expected to be the hub of the local intelligence gathering effort with responsibility for the timely and accurate passage of information in a variety of directions around the service. A number of recent reports and publications have emphasized the limitations of routine patrolling and the importance of accurately targeted policework based on a problem solving ethos (HMIC 1997; Leigh *et al.* 1996; Maguire and John 1995; Woodhouse 1997). A repeating theme throughout these works is the requirement to maximize the interpretation of available data to generate intelligence, and the need for accurate dissemination of the result. A number of police agencies have undergone organizational and technical changes in an attempt to improve the lines of communication and to smooth the flow of intelligence within the service (Barton and Evans 1999; Seddon and Napper 1999). This has been implemented so that the necessary intelligence is available for operational officers. It has been recognized that patrolling officers and their supervisors should become familiar with the vulnerable crime areas, especially with regard to high volume crime such as burglary and vehicle crime. This information should enable them to target resources to the most needed areas. There is however an old adage within the police service that a 'good copper knows where the crime is happening'. It suggests that officers, through their day-to-day activities, develop an accurate perception of the location of high volume crime areas. The way that officers build a mental picture of their beat has been examined in the United States (Herbert 1997; Klinger 1997). George Rengert surveyed the cognitive hotspots of crime of Philadelphia police recruits, concluding that asking them to identify the safest parts of the city was not as informative as if he had asked them to identify the highest crime areas (Rengert 1995). The study presented here uses more experienced

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police officers and builds on the suggestions of Rengert. It should also be noted that little work has examined the geographical perception of police officers in the United Kingdom. This paper examines the hypothesis that operational officers know where the high crime areas of their beat are located, by comparing a number of computer generated hotspot maps against a survey of police officers' perception of high volume crime areas for a police division in Nottingham. Follow-up focus groups intended to further interpret the results reveal limitations in current methods of intelligence dissemination. This paper builds on a description of the spatial analysis technique in an earlier paper (Ratcliffe and McCullagh 1999) by exploring the results of the police survey in greater detail and examining the implications for intelligence dissemination in modern policing.

To examine the truth behind the adage mentioned in the previous paragraph, the study employed data from the police crime recording system to analyse three types of high volume recorded crime: residential burglary, non-residential burglary, and vehicle crime. Recorded crime is defined in this study as all criminal activity reported to the police and recorded in the Nottinghamshire Police crime recording system. This is the same database that is used to construct statistical returns to the Home Office. Non-residential burglary includes all incidents of burglary at commercial premises, such as shops and factories, schools and any premises not considered to be a domestic dwelling. The analysis was completed for three subdivisional areas of South Nottinghamshire. In all three subdivisions, both burglary and vehicle crime are published local policing priorities, and all three crime types were monitored by the divisional command. All three subdivisions are on the border of the City of Nottingham and contain a dense mix of social and more affluent suburban housing. The population sizes of the divisions vary with subdivision A being home to approximately 26,000 residents, subdivision B having approximately 10,000 residents and subdivision C being the largest with about 34,000 inhabitants. A more detailed description of the subdivisions follows Table 1. The third column of Table 1 shows the number of each of the three types of crime committed from April 1996 to April 1997. Police recorded crime was searched for hotspots using an innovative two-stage process within a geographical information system (GIS) (Ratcliffe and McCullagh 1999). The output was then compared with survey data from Nottinghamshire Police officers, and finally three focus groups were employed to improve interpretation of the comparison. These three aspects of the research are discussed in the following sections.

Hotspot Analysis

A current buzzword in policing is 'hotspots'. The detection and management of crime hotspots is seen as a priority by the Home Office who have allocated £32m as part of the Home Office targeted policing initiative (Home Office 1999) to three main areas, of which a greater understanding of hotspots is one. While descriptions of hotspots vary, a general definition of a hotspot is an area that is the target of a higher than expected level of criminal activity. Crime hotspots have a distinctly spatial nature and accurate identification of hotspots is an important crime prevention tool. Computer systems are now seen as an essential part of this identification process, and a number of police agencies have extended the drive in information technology to include GIS.

GIS gives the police the ability to map and analyse the spatial distribution of crime and can reveal patterns of criminal activity that would not otherwise be apparent through more traditional means. A survey completed in May 1999 found that nearly half (44 per cent) of British police services now have the ability to distribute maps of crime locations at the local area command (LAC) level (Ratcliffe 2000). An example of the use of GIS in crime analysis is the description by Phil Canter of the development and applications of GIS in the analysis of Baltimore County crime patterns (Canter 1998). Often crime mapping is used to identify the extent of a crime problem, and to enable the targeting of resources to deal with the problem. A growing trend is for local area commanders to be shown maps of crime distribution in their area of command and for the individuals to be made responsible for the management of the identified pattern. This trend originated in New York with the CompStat process, and this style of mapping and problem solving is now popular in other law enforcement agencies, though sometimes termed differently (Gorta 1997).

Viewing a mass of points on a computer cartographic display can be confusing in the case of high volume data and computer programs that extract the hotspots can be used to simplify visual displays and allow for easier interpretation of the crime patterns. A number of spatial analysis techniques for hotspot identification are available for the analysis and display of crime patterns. The Crime Mapping Research Center in Washington DC has supported research into the applicability of a number of spatial algorithms including: cluster analysis, nearest neighbour techniques, k-means processes and Local Indicators of Spatial Association (LISA) statistics. One of the more popular hotspot generation packages is called STAC (Spatial and Temporal Analysis of Crime) and is available from the Illinois Criminal Justice Information Authority. However the STAC process has a questionable statistical basis (the top 25 results of an initial pass are retained for further analysis, an apparently arbitrary number) and the detected hotspots are always displayed by STAC as standard deviational ellipses (ICJIA 1996), a shape rarely mimicked by urban geography.

The Nottingham study employed a two-stage process that first generated a surface of crime intensity and then searched this surface for statistically significant local hotspots using a type of statistic known as a LISA (Local Indicator of Spatial Association) statistic (Anselin 1995). The first stage was completed within a GIS where a virtual grid was superimposed over the crime locations for each type of crime activity. A quartic kernel intensity estimation process (Bailey and Gatrell 1995) generated a continuous surface of crime intensity. The surface was then tested to determine areas of significantly higher values. While a number of spatial algorithms employ global analysis methods to determine if there is any departure from complete spatial randomness across the whole surface, LISA statistics enable the user to determine if individual pockets of the study area display significantly higher values, relative to the mean and variance of the whole area. One previous study in Philadelphia examined crime with a local Moran I type LISA statistic (Chakravorty 1995) though the researcher had to construct artificial hotspots to demonstrate the technique. The present study uses a different LISA statistic described by Getis and Ord (Getis and Ord 1992, 1996; Ord and Getis 1995). The combined techniques of continuous surface generation followed by the application of Getis and Ord's G_i^* statistic allow the crime locations, described as geographical points, to be searched for significant hotspots at a level of statistical significance dictated by the user. The result is a graphical output that is both significant and robust in a statistical sense,

and has a geometrically realistic shape that reflects the geography of the crime distribution. For a fuller account of the technique see Ratcliffe and McCullagh (1999).

Perception Survey and Focus Groups

The crime hotspots generated from the recorded crime data were compared with the results from a survey of 65 Nottinghamshire Police officers. Only operational officers who worked on regular street duties were targeted for the survey, as it was felt that non-operational supervising officers were both less likely to be familiar with the crime distribution on the division, and were also not the target of the divisional information systems. Although 65 officers does not sound like a large number for a survey, readers from metropolitan areas should be aware that the manpower of the three target areas is not high, and over 80 per cent of possible officers were surveyed. The survey took place between February and April 1998 during which time each operational officer was presented with a number of maps of their specific subdivision and asked to indicate on these maps the locations of the crime hotspots for the three types of high volume crime: vehicle crime, residential burglary and non-residential burglary. The officers were only asked about crime on their own subdivision. As they are not working in rural areas, the officers rapidly gain experience of the whole of their subdivision and are rarely, if ever, posted to only one part of the patrol. It was therefore possible to ask them for their perception of crime across their subdivision. Multiple responses on each of the maps were permitted, as were nil returns if the officer felt that there were no areas of concentrated activity. The marked locations from the survey maps were digitized for later comparison within MapInfo, a proprietary GIS package. The survey was introduced to the officers by one of the authors to outline the purpose behind the research and to be available to answer any questions that should occur. Surveying the officers in this manner showed the areas where an officer felt there was a centre of intensive criminal activity for different crime types—a perceived hotspot.

Police officers are probably one of the few groups which could be relied upon with some confidence to complete this type of survey. The geographical nature of policing, from county forces down to individual beats, means that an officer has to become intimately familiar with their patrol area and in doing so develops good spatial awareness. Their comprehension of locations and relative distances from the maps is generally better than one would expect from the public. On arrival at a new station, officers are issued with a local street map to enable them to navigate and perform their duties effectively, and to build up a mental map of the area based on the street map. Reference to the street map usually becomes unnecessary after a short operational period. In this survey it was found that officers had no problems identifying locations from street maps, even when some officers had not needed to look at a street map for years. The officers were easily able to visualize mentally each location and the surrounding environment and project their impression of the level of crime in the region.

Three focus groups—one at each subdivisional station—were conducted to interpret more accurately the results from the hotspot analysis and perception study. Each session had the same format in line with general focus group guidelines (Greenbaum 1993: 43). The sessions were run with mini-groups, a term used to indicate groups sizes of 4–6

people, with the role of moderator being performed by the author. Participant recruitment was left in the hands of the section inspectors due to their better knowledge of the available participants. The inspectors were asked to identify individuals who had an extensive understanding and experience of the crime problems of the area, and who would take an active interest in this type of research. The authors realize that the nonrandom selection of focus group participants may have had an affect on the outcome of the groups, however, as the officers were on duty at the time there were operational constraints placed on this area of the research. The selection of participants was based as much on the operational needs of the division as the wishes of the researchers.

There was an initial warm-up session where the moderator was introduced (the participants knew each other already), and the participants were introduced to the moderator. A details section followed which discussed the technical aspects of the survey including; the mapping technique, the survey methodology and the display of the results. The contents section gave the respondents a wide rein to interpret the results of the survey and explain possible causes for some of the findings. The session was then directed by the moderator into a discussion of the means by which police officers receive information about crime and incidents in their area, and a discussion of crime in their area in general. This was the longest section of each focus group. The group work concluded with a summary section where the participants were asked for any last thoughts, the moderator summarized his notes, and checked with the group that his interpretation of the session was correct.

One important *caveat* of the research is the difference between the survey time period and the crime data analysed. The respondents were asked to identify hotspots of crime based on the period from the end of August 1997 to the end of February 1998. Complete data for this period were unavailable so this study therefore used crime data from the most recent period available to the survey: April 1996 to April 1997. A year's worth of data were used in an attempt to iron out any short term fluctuations in the data and hopefully identify the long term hotspots as consistent and continuous problem areas. This discrepancy between the survey enquiry dates and the available crime data used for the hotspot analysis is a limiting factor in the analysis that should be noted. It is possible that crime hotspots moved in the intervening period and though the crime data analysis attempted to identify long term problem areas and minimize this effect, it should be emphasized that there is a possibility that any miscorrelation between the police perception mapping and the hotspot maps may be due to short term fluctuations in hotspot location. This possibility was raised with officers during the focus groups, who felt that there had not been any recent changes in patterns of criminal activity. Minor movements in hotspot area will have been absorbed in the analysis due to a buffer that the hotspot generation process creates.

Comparison of Hotspots and Survey

Table 1 shows for each crime type at each subdivisional station: the number of crimes used to generate the hotspots, the number of hotspots generated from the recorded crime data, the number of police hotspot estimates from the survey, the percentage of the subdivisional area that consisted of a hotspot area, and the number of police estimates that were within a hotspot area expressed as a number and as a percentage.

TABLE 1 *Crime hotspots, police estimates, and accuracy*

Subdivision	Crime type	Number of crimes	Generated hotspots	Police estimates	Hotspot coverage of subdivision (%)	Correct estimates
A	Residential burglary	354	6	38	14.2	25 (66%)
	Non-residential burglary	257	19	28	6.8	12 (43%)
	Motor vehicle crime	312	19	27	6.6	11 (41%)
B	Residential burglary	289	1	56	12.4	51 (91%)
	Non-residential burglary	215	9	41	18.6	15 (37%)
	Motor vehicle crime	504	4	55	25.0	33 (60%)
C	Residential burglary	603	1	53	18.2	33 (62%)
	Non-residential burglary	403	10	28	10.5	13 (46%)
	Motor vehicle crime	1110	2	47	17.1	23 (49%)

Table 1 shows that subdivision A has a higher number of hotspots in each category than the other two areas, and consists of a much more heterogeneous urban land use mix. Pockets of commercial areas, social housing and private residential estates are intermingled. Hotspot analysis of the crime data of subdivision A created a larger number of small discrete hotspot areas, reflecting both the level of criminal activity in these areas and the urban geography of the region. Number and size of hotspots generated automatically is partly a function of spatial search parameters set by the user (Ratcliffe and McCullagh 1999). Subdivision B is a smaller inner city region with a high percentage of social housing bordering the central business district of Nottingham. The land use of the subdivision is more homogenous than the other areas with clear demarcation between social housing and commercial areas. Although subdivision C also has a mix of housing types and commercial land use, it has a substantially larger area than the other two regions and has larger, more homogenous estates.

Table 1 also shows that police perception of crime hotspots varied considerably with crime type. The police perception of the most vulnerable areas for residential burglary coincided with the hotspot analysis over 60 per cent of the time. On one subdivision (B) the correlation was over 90 per cent in this category of crime. The officers of subdivision B managed to predict accurately hotspot areas for vehicle crime in 60 per cent of cases. The penultimate column shows that a quarter of the subdivision was considered to be a hotspot at the 99.9 per cent statistical error level. With a large target area to aim for it is perhaps unsurprising that a reasonable correlation between perception and computer-generated region was obtained for this category at subdivision B. On the remaining subdivisions a correlation between the hotspots and the survey was not achievable more than half of the time for vehicle crime. It should be noted that the low correlation rate on subdivision A may be related to the smaller hotspot target area available. With less than 10 per cent of the subdivisional area considered a hotspot, an area split into 19 parts, it is not unreasonable to appreciate why there was a low success rate.

Figure 1 shows two examples of the type of map generated for hotspot perception analysis. Figure 1a indicates the considerable similarity between automatic hotspot detection and police perception in the case of residential burglary in subdivision B, while Figure 1b gives an example for subdivision C of the differences between the perception

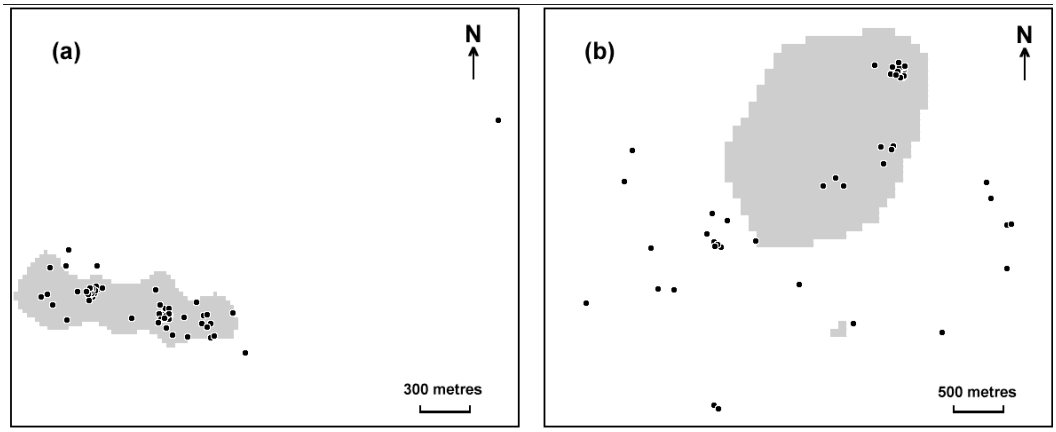

FIG. 1 Residential burglary hotspots created by computer for subdivision B are shown in 1a in grey shading, with police estimates shown as dots. Similarly, motor vehicle hotspots and police estimates are given in 1b for subdivision C

of operational police and computer-generated well-defined motor vehicle crime hotspots. In both cases the criteria for parameter selection for automatic hot spot detection were identical. The police perception estimates were not hampered by a scarcity of vehicle crime data, in fact probably the opposite—there were 1,110 crime locations in the area during the survey year. This compares with the much more accurate recognition by the police of residential burglary hotspots from 289 incidents. These two examples were chosen to represent the extreme of the recognition spectrum; many other hotspot perception analysis maps exhibited less clear cut distinctions according to crime type. But the point remains that in a majority of cases the perception of operational police differed significantly from the computerized hotspot generation process.

Focus Group Results

The focus groups raised issues regarding intelligence dissemination that were unique for each subdivision. At each of the stations a different method of passing intelligence about local crime distribution was employed, and the officers felt that their knowledge of the crime patterns was directly related to the subdivisional information handling procedure. There were also a number of issues relating to the officers' general feelings about crime and priorities. The following section will deal with the situation at each individual subdivisional station first.

At the first subdivision (A) officers felt there was less crime than in the other subdivisions (though Table 1 shows there are similar crime levels to subdivision B). Officers were briefed by a sergeant who read out the crimes and incidents that had come to notice over the recent hours or days. Contrary to the hotspot analysis that showed specific hotspot areas, it was felt that vehicle crime was sporadic and 'all over the ground'. Little enthusiasm was evident for tackling vehicle crime, and the emphasis of the officers was mainly on burglary. According to the focus group participants the divisional intelligence

unit rarely gave them intelligence targets to watch and when it did they were always burglary targets. Vehicle crime suspects were ignored as there are always 'better targets we can do something about'. Within the division there is an importance attached to burglary which is not the same for motor vehicle crime. 'Vehicle crime is seen as an inevitability' was a common and, given the relative levels of crime, understandable attitude.

The officers mentioned a previously operated system of placing crime locations on a map with pins. The usual problems with this type of crime mapping (what to do when the map is full of pins, pins fall out, not interactive etc.) were cited as the reasons for its eventual demise. It was noted that the system ground to a halt once the individual who was enthusiastic about the pin map was transferred to another station.

At the second station (B), information was passed from shift to shift by writing the information on a whiteboard, and from briefing sheets prepared by an intelligence unit. This was felt to be an acceptable means of information dissemination because the station area is small and the numbers of incidents relatively few. The burglary and vehicle crime locations are written onto the board and are available for all to see, though one sergeant did say: 'You can come on in the morning and find 20 autocrimes, and only two burglaries which are much easier to remember.' Although a divisional priority, vehicle crime was again seen as a low priority. The crime desk (a telephone helpdesk at the divisional headquarters) records most of the vehicle crime directly with little or no involvement from patrolling officers. Only if there is the presence or knowledge of a suspect, or the possibility of fingerprint evidence, will an officer attend a vehicle crime incident. As with the other subdivisions there was less enthusiasm for tackling vehicle crime and a recognition of the less personal nature of the crime: 'Well, nobody gets hurt or that upset by it [vehicle crime], not like they do at a burglary.'

At the third subdivision (C) a new computer system has been introduced to aid intelligence briefings at the beginning of a shift. The system is used to pass information from one shift to another and only retains information for a 24–hour period. It performs no analysis and is merely a text handling device reliant on an intelligence officer or other individual entering relevant information for others to browse. The information is usually absorbed by the shift sergeant who reads out the relevant information to the patrolling officers. The focus group officers felt that if a burglary was attended and reported by a normal shift officer then it would appear on the computer and word of mouth might also spread details about the crime. In this manner they felt that they were updated with the locations of recent burglaries, either residential or non-residential.

Although occasional vehicle crimes were entered on to the computer briefing system, they were seen unofficially as a lower priority. It was felt that vehicle crime had always been 'all over the place' (even though the hotspot maps showed this is not the case) and if the locations were read out on parade or entered on to the briefing computer there was too much information. As one PC said: 'A few locations you can remember but with autocrime you get swamped with information overload.' There was also the feeling that motor vehicle crime was becoming 'decriminalized'. Officers rarely attend the crime scene, and it was felt that crime prevention advice was rarely distributed. The officers thought that the victim is generally interested only in obtaining a crime report number that is needed for the insurance claim. To quote one officer: 'We do not consider autocrime to be nearly as important as burglary.'

There was one issue that affected all of the subdivisions. The division-wide introduction of a programme of Crime Scene Visitors resulted in fewer operational officers

attending burglaries. Crime Scene Visitors are police officers dedicated to the reporting of burglaries with special training in crime prevention, the needs of the crime scene officer (forensics) and with a good knowledge of the local burglars. These officers are the first allocation choice when burglaries are to be reported. Although the use of Crime Scene Visitors was seen generally as an improvement in the service to the public and a more professional approach to burglary recording, it made the operational officer more remote from access to information about local burglary activity. One inspector said that the use of Crime Scene Visitors 'takes away the knowledge base of the officers' regarding burglaries. There was a general concern that the information flow about recent burglaries was not reaching the operational officers responsible for crime detection and prevention.

To summarize, the focus groups produced similar results at all three stations:

- Residential burglary is seen as a higher priority than both non-residential burglary or vehicle crime.
- Burglary is seen as a preventable crime whereas vehicle crime is seen as an inevitability.
- The use of Burglary Scene Visitors to report burglaries was perceived to reduce the local crime knowledge of officers.
- Vehicle crime is perceived to be endemic to all areas of the division.
- Vehicle crime was seen as a low priority and the focus group officers considered that the police had more pressing matters and the public are not interested.
- Because vehicle crimes are rarely reported by operational officers their locations are not known.
- The means for disseminating the vehicle crime locations were not working as there was either too much information and officers were 'swamped', or there was not enough information.

Discussion

This study has shown that while police perception of residential burglary patterns correlates well with the empirical study, there is less correlation in the areas of vehicle crime or non-residential burglary. The current dissemination methods of whiteboards and static text on computers would appear not to be successful in fully imparting the areas of concern to officers for these types of offence.

Attending and reporting a burglary from a distraught member of the public left an impact on officers and the location of one incident would understandably bias the judgement of some officers as to the locations of hotspots. The intelligence dissemination process at each station did not help in that no information is displayed spatially. At the time of the survey and focus groups, there were no institutional facilities to display crime distribution in any cartographic manner or spatial context either at headquarters or at the local area command level. It is not surprising therefore that there was some difference between the perception survey and the hotspot analysis.

The officers surveyed had a good correlation rate with residential burglary hotspots, which can be attributed to their professional interest in preventing a crime that is

disturbing and upsetting to the public, and which is given a higher local priority by colleagues and the intelligence unit. If operational police officers' perception of residential burglary hotspots correlates with an impartial computer analysis, but differs from other crime types, the question arises as to how hotspots of other crime types are identified locally. The issue of correctly identifying problems has come to the fore with the introduction of the Crime and Disorder Bill 1998. Clauses 6 and 7 of this act require the police to work in conjunction with local authorities in drawing up a local action plan to combat crime problems, the first stage of which is the publishing of a local crime audit (Home Office 1998). The importance of identifying accurately significant hotspots of crime can therefore be seen as important in the context of this government bill.

In a time when any increases in police numbers have not in any way matched the broader role and increased workload of the police (Morgan and Newburn 1997) the current move towards an intelligence-led approach to crime seems a worthwhile experiment. The accurate targeting of police resources to the right problem at the right time in the right place is a fundamental aim of a proactive intelligence-led police service. In contemporary Britain where vehicle crime is seen as an epidemic and the risk of burglary is a significant public concern, getting the right intelligence to the operational officers would seem a priority, and yet the very high volume nature of these 'popular' crimes means that there is often too much spatial information for officers to absorb objectively. One seductive appeal of a GIS is the ability to use techniques such as hotspot analysis to accurately summarize high volumes of data into meaningful yet simplified displays. If the maxim 'A picture is worth a thousand words' holds true, then GIS is the high-tech, automated end of the picture production process. In the context of policing, GIS can provide the appropriate level of output for the required task. An example of this is demonstrated in the mapping support to Operations and Crime Review meetings held by the New South Wales Police Service. Mapping is used to review crime distribution and volume with local area commanders. The facility has the ability to portray simplified hotspot maps for an appreciation of crime distribution across the whole command, but it is also possible to magnify specific areas and examine the pattern of individual points.

We suggest that the hotspot perception analysis technique presented here can give a police commander or researcher valuable information about the intelligence dissemination process. Knowledge of the hotspots of high volume crime is usually an aim (though often unstated) of intelligence units and this method allows the success of the dissemination process to be judged. The potential for a mapping system to improve the information flow can also be assessed, or indeed an appraisal of an existing system where one exists. At least one of the subdivisions surveyed now has implemented a local crime mapping system in response to this study and similar work in other police service areas may also highlight difficulties in the intelligence cycle that can be as quickly corrected. The ability to use GIS to refine the perception of officers in relation to the distribution of crime on their patrol area would be a step towards a more intelligence-led solution to the problem of high volume crime, a problem that has been historically difficult to quantify and model. The concepts of intelligence-led policing are rooted in the belief that proactive, problem-oriented policing can be driven by accurate information. Prediction of future crime trends is based on historical patterns and a GIS can be utilized to enhance the police perception of recent historical crime distribution.

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