Police crime recording and investigation systems – A user's view

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A User's View

INTRODUCTION

Recent years have seen an increasing use of computers within Police Forces, not just in general administration (e.g. payroll, personnel, e-mail, general office suites etc.), but also as a tool to assist the core business activity of policing (preventing and solving) crime. Increasing crime rates and the (greater awareness of modern criminals) puts a strain on existing methods and techniques. There is therefore a clear need for the application of advanced software technologies in order to make the best use of limited resources.

The objective of this paper is to provide an insight into the role software systems are playing in Police Forces, primarily in the United Kingdom but also in North America and Europe. Many of these systems are in-house developments by individual Police Forces or commercial products, hence few details can be found in the academic literature. Some of the information contained within this paper was gathered by word of mouth from the developers. As a consequence many of the details of specific systems are sketchy. It is hoped however, that this paper will be of interest not only to those working on related systems but also to those with a general interest in how advanced software technologies are being applied to a challenging application area.

THE TASK

Crime occurs in a variety of forms. Police informally categorise crime as being either major or volume.

Major crime consists of the high profile crimes such as murder, armed robbery and non-date rape. These crimes can either be one-offs or serial. In the case of serial crimes it is relatively easy to link crimes together due to clear similarities in terms of *modus operandi* or descriptions of offenders. This linking is possible due to the comparatively low volume of such crimes. Major crimes usually have a team of detectives allocated to conduct the investigation.

In contrast volume crimes such as burglary and shoplifting are far more prevalent. They are usually serial in nature as offenders go on to commit many such crimes. Property crimes, such as domestic burglary offences, committed by different individuals are highly similar and it is rare to have a description of the offenders. This makes it difficult to link crimes together. Also a single Detective Officer may have up to 40 different volume crimes to investigate at any point in time. Within the West Midlands Police area, in the last decade, total crime has risen by 15.1% whereas police establishment has only risen 7.7%.

With a view to satisfying this demand Police Forces around the world employ specialist Crime Analysts, people who have specialist training in a variety of disciplines including investigation techniques, criminal psychology and information technology. It is their task to assist investigating Officers by analysing crime trends and patterns, identifying links between crimes and producing packages which targets an individual or group of offenders linking them to a series of crimes.

Most, if not all, of current systems both manual and computerised revolve around the investigation of crimes already committed. They are, therefore, reactive. The majority of UK Forces use different types of relational database management systems (RDBMS) for recording and subsequent analysis of crime. Standard or interactive queries are written to produce patterns of crime, offending and various statistics.

SPECIAL PURPOSE SOFTWARE TOOLS

The development of software for dedicated tasks such as fingerprint matching, scene of crime reconstruction and vehicle number plate recognition have been areas of active research for a number of years. These systems can be used as tools for major or volume crime but their dedicated nature (i.e. a well defined objective) lies outside the scope of the current review into crime analysis. They are also covered well in the academic literature and the interested reader should consult the cited literature for details.

COMPUTERISED CRIME SYSTEMS FOR DEALING WITH MAJOR CRIMES

The investigation of a major crime generates a large volume of data and information related to the particular crime, or series of crime. This data can overwhelm any single individual. Partitioning the data between team members may not help due to the partition obscuring possible links. This problem has motivated a variety of approaches to use the power of computers to assist in the management of this voluminous data.

Home Office Large Major Enquiry System (HOLMES)

All 43 UK Police Forces use the current HOLMES system that is approximately 12 years old. There are 5 variant main systems produced by

Bull, ICL, CGS UK Ltd., Unisys and MDIS each using its own proprietary database, programming and query language. Information cannot easily be transferred between systems, in fact, there is only a limited linking facility between systems from the same manufacturer.

The West Midlands Police use the Bull system that has 54 different files, which are accessed by the various programs written in a proprietary language. Embedded within the system is the Status text processing program. HOLMES uses a Bull utility, Transaction Processing System (TPS), to extract text from the files and compile the Status database. To search for “red Vauxhall” the system will instigate a procedure, which is transparent to the user, by firstly searching the vehicle file and then the Status database.

Within the present HOLMES systems all data is limited to a single incident, no searching can occur across incidents thereby imposing obvious limitations.

HOLMES2 began its testing phase at the end of 1997 offering many advantages over the existing system. It uses a Dynamic Reasoning Engine (DRE) within a RDBMS in a Microsoft Windows environment that has been developed by Cambridge Neurodynamics Limited, England [1]. The engine is capable of searching all incidents on the system with the facility of using natural language searches. The results are a list of documents that are possibly linked to or have a relationship with previously unconnected documents and a list of possible keywords is produced which may be used in future searches. The engine may be used in automatic mode, manual mode or a combination of these modes thereby allowing the enquirer full control of the AI used.

Compatibly between different Police Forces is ensured as the system was designed and built by a single contractor.

Interpol

Interpol has been the centre of police co-operation for its 177 member states for almost 75 years. Its computer system centralises data from members' National Central Bureaux (NCBs) which amount to 100 000 new documents annually. These are stored and archived in the main database in Lyon, France. Data is enriched and annotated and a selection is made available to NCBs through an Interpol designed Automated Search Facility. It is now moving from its mainframe-based system to IBM RS/6000s running relational database technology from Oracle [2].

The project was launched in 1996 with the objective of integrating the three diverse systems of the core criminal database, the Electronic Archive and the Automated Search Facility. It was expected to roll out the system in late 1997 when there will be two copies of the integrated database: a master copy for standard search facilities and a replicated copy supporting the use of more complex crime analysis tools. The visualisation tool, i2 (see below for software description) will be used to analyse complex searches through telephone or bank account numbers. Free text searching across the database will retrieve information that is often received out of context and the ability to store very high resolution colour images will assist in the tracking of stolen works of art, credit cards etc. It is now possible to provide an image of a stolen or counterfeit credit card to the central system and it being made available to all member states worldwide within hours.

Violent Criminal Apprehension System. (VICAP)

The Federal Bureau of Investigation developed the VICAP system that uses pattern analysis to monitor case activity enabling the investigator(s) to trace the travelling criminal who is actively involved in major violent crime. The types of cases examined by this system include: (i) solved or unsolved murders (or attempted murders) that are apparently random, motiveless or sexually oriented; or are known or suspected to be part of a series (ii) missing persons where there is suspicion of foul play and (iii) unidentified dead bodies where murder is suspected.

When a new case is entered, the system simultaneously compares and contrasts 188 variables relating to MO categories against those held in the database. The output is a listing of the ten cases that most resemble the one being entered. The VICAP system has case management administration facilities, investigation support (time lines, investigative matrix etc.) and facilitates crime investigation training.

Criminal Geographic Targeting (CGT)

During 1995 the Vancouver Police Department Police Department introduced the CGT system which was developed by one of their Officers, Dr. Kim Rossmo [3]. This system investigates the probable spatial behaviour of an offender by examining information which can be found at known crime site locations such as encounter/apprehension sites; murder scenes; body/property dump sites.

The system reverses the approach of environmental criminologists who use sociological information such as the offender's background, peer influences criminal careers etc. to describe, understand and control criminal events. The

relationship between an offender's home and the crimes he or she commits is the underlying theme of their work. Rossmo reverses this reasoning to predict the most probable location of a criminal's residence by using the locations of a series of crimes. The result is a three-dimensional plot, the height representing the relative probability that a given point is the residence or workplace of the offender that is overlaid onto a local map.

The system was initially validated on several solved crimes locating the offender's residence in the top 5% or potential locations. Subsequently the system has had a number of successes [4], in one notorious case the then current investigative systems suggested that the killer could have lived within a 2,000 square kilometre area, Rossmo's software indicated that the search should be restricted to a 10 square kilometre area. The offender, who lived within that restricted area, was subsequently captured and convicted. It was also used in a case where a 16-year-old girl was murdered and another left for dead. The software suggested a search area of 1.5 square kilometres from a possible area of 26 square kilometres. The offender who lived within that search area was arrested and charged with the offences.

This system is now commercially produced under the name ORION [5].

COMPUTERISED CRIME SYSTEMS FOR DEALING WITH VOLUME CRIMES

Most crime is not major. Individual crimes are of a less serious nature to society as a whole (although still serious to the victims). The shear volume of such crimes creates different types of problems for the investigator. The high degree of similarity between crimes and the lack of resources for detailed investigation of any one particular crime creates problems in both solving a

crime and preventing similar future crimes. The challenge for advanced software developers is to apply modern pattern matching and visualisation techniques to alleviate the problem.

Crime Report Information System (CRIS)

In the late 1980's the London Metropolitan Police conceived CRIS [6] as a computerised system to replace the paper based crime reporting system with a database covering the entire Metropolitan Police area. Various solutions were tried but it was only in August 1994 when a contract was agreed with EDS Ltd. based on new high performance computers and data networks that the vision could be realised.

The information is stored in an Ingress database distributed across two VAX 7600 central computers that mirrors all 63 Divisional databases and is updated in real time [7]. Each Division has both a front-end and back-end processor connected by X25 network and each Sub-Division is connected to this by a multiplexer. A Graphical Query Language (GQL) is currently being used to access information and download into Microsoft Office applications and MapInfo for geographically plotting 'hot spots'.

Searches undertaken using divisional data are 'held' on the divisional computer, however, cross-boarder searches are viable and are conducted centrally. As the data is stored in real time any requests for information will automatically include the most up to date results. The system has produced information that has lead to many arrests, the first reported being related to car crime [8]. Officers used the system to build up a picture of a car crime wave in Surbitan, Southwest London and found that they followed a pattern of time, location, method and type of car stolen. The Police established a decoy vehicle

and caught the offenders within two hours. This is an illustrative example of how a computerised criminal investigation software can be used for pro-active policing.

Crime Pattern Analysis System (CPAS)

The West Midlands Police use CPAS which provides digital maps to display all or specific types of crime that occur in a defined area. The system will analyse the data and produce a coloured graphical overlay on the map to show the density of crime. It also has the facility, using statistical techniques, to extrapolate total crime figures for a series of dates and predict where crime will occur 'tomorrow'.

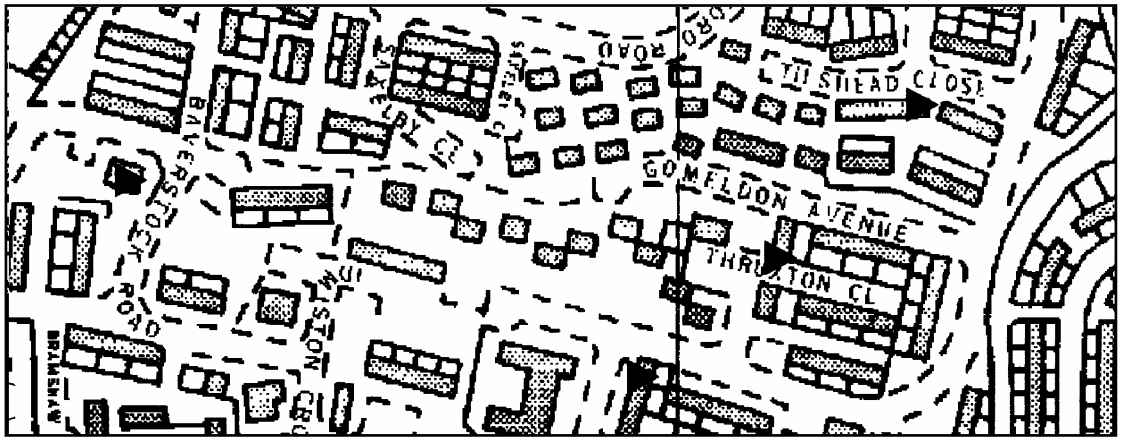

Figure 1. Crime density levels

The prediction is overlaid onto the map. This information can be used to aid manpower planning and resource allocation. It is not currently used for solving specific individual crimes or series of crimes committed by the same offender(s).

Action Information Management (AIM)

During 1997 Suffolk Police piloted a crime mapping system which, extracts information from their recording systems to display, via Action

Information Management software, instances of crime onto an Ordinance Survey map of the relevant area. The system will plot all/different types of crime and export summary data into spreadsheets for reporting or further analysis. By indicating a single crime it is possible to plot all offenders that are associated to that crime thereby indicating the distance travelled to commit the crime. By indicating an offender it will plot all crimes associated with that person thereby indicating the radius of criminal activity including date/time and type of crime committed.

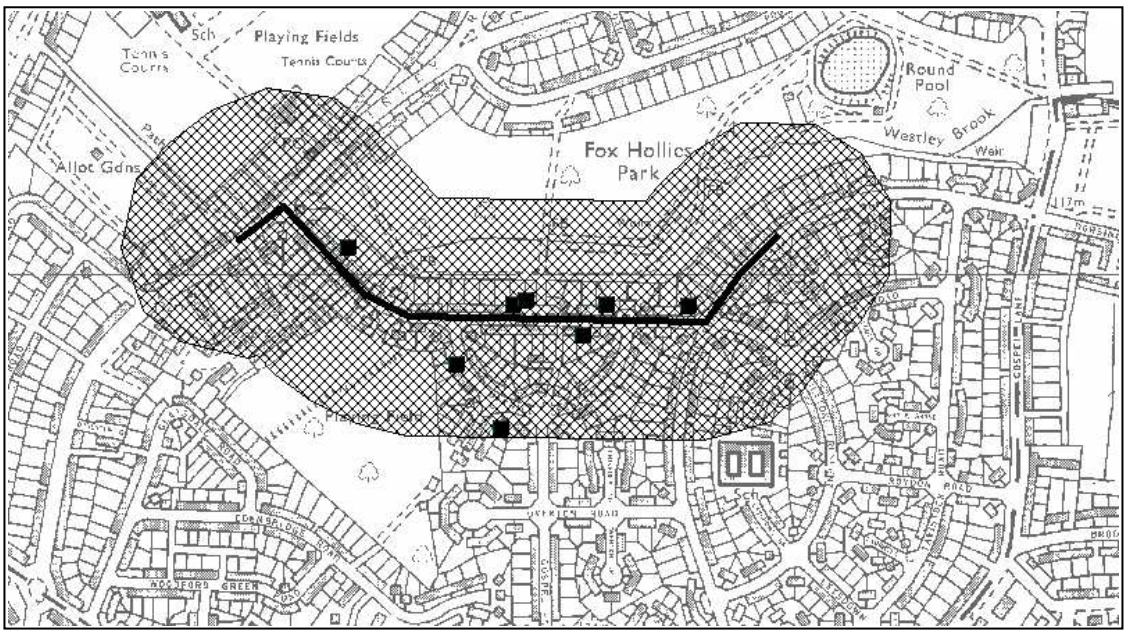

Figure 2. Crime Buffer Zones

This system has the ability to plot crime corridors by placing all known addresses (i.e. offenders and known associates) of an offender on the map and then connecting them by drawing a line along the streets. It is then possible for the system to create a 'buffer zone' (a polygon) around the street lines at a user defined distance i.e. 100 meters. All of the crimes within the zone for which the offender has been charged are then displayed followed by all similar

outstanding crimes. This will enable detectives to target the offender's activity or, if already in custody, be ready to further question.

This is illustrated in the diagram below, the black squares representing the crimes that fall within the zone.

i2

All of the UK, Dutch, Swedish and New Zealand Police Forces, various Australian Forces and USA legal departments (including the FBI) [9] utilise the data visualisation suite of software, Analyst Notebook. There are four main areas within this suite: -

Link Analysis

This type of diagram displays the associations between different entities, which may be a person, vehicle, organisation, telephone number etc. It will also show the flow of commodities such as money or property.

Network Analysis

Network diagrams are used on large data sets to extend the link analysis concepts. This area is mainly used to analyse telephone transactions, account transfers and Internet traffic. The system will allow optical character reading (OCR) of information such as telephone bills and automatically displaying the related links.

Event Sequence

This time line chart reveals how related events unfold. It is particularly useful in visualising the cause and effect between events and sequence simulation by automatically arranging events in chronological order and branching between them.

Transaction Pattern Analysis

The chart analyses the significant activity between subjects. It is particularly useful in visualising repeated activity patterns such as a sequence of telephone calls indicating a chain of command or a sequence of account transfers indicating money laundering.

The i2 software was used in the preparation for and during the Euro 96 football tournament [10] where in excess of 7500 potential troublemakers were expected to arrive in England. Specialist Officers used the software to reveal unexpected links between apparently unconnected people.

Watson

Watson is an integrated suite of investigative case management and intelligence analysis software used by several UK and Australian Police Forces, many USA Police Departments and various UK and USA government departments [11].

This operational intelligence tool has the ability to track and interpret data from a wide range of sources by connecting to the source or importing the data, automatically displaying links. Questions can be formulated without knowing the data contents: -

1. Ask a question by specifying the objects of your enquiry
2. Receive the answer in a chart
3. Analyse the chart to identify facts or create new lines of enquiry
4. Ask another question

Queries can be saved for later use or applied to different data sets. Using a 'Visualisation by Query' methodology, Watson will produce custom designed charts, links between data and/or events, hierarchies and transactions. The chart displays are similar to those in i2. It will also generate activity timelines and

reports. The linking includes investigating networks of contacts, cashflow transactions and telephone analysis.

The case management tool, which seamlessly integrates with Watson, enables Senior Investigating Officers (SIO's) to maintain a structured and methodological approach to the investigation thereby reducing the amount of administration. PowerIndexing™ automatically cross-references database information identifying and tagging records and objects then identifying their relationship to one another. An auto research function can be applied to transaction data i.e. telephone calls, cash transactions, which highlights relationships between, possibly, thousands of records. There are three management modules within this tool: **Action Management,** the identification of relevant lines of enquiry; **Task Management,** the allocation of specific tasks to specific people allowing SIO's to monitor the workflow and prioritise tasks and resource assignments; **Document Management -** tracking of the extent that a document was processed, by who and when. It was last updated.

Watson was used in a notorious UK murder case (the Naomi Smith case [10]) by linking into HOLMES data producing data links between people, vehicles, crime scenes etc. could be visually displayed (e.g. question: "…was there any relationship between Mr X and Mr Y…"). In this way a large number of attributes were matched at one time. While detectives were utilising this information, scientists made a breakthrough in identifying the offender's DNA that resulted in the undertaking that all males between 15 and 28 years old would be DNA tested. Watson, together with HOLMES, identified a reduced set of males to be initially tested and, during the testing process, the offender's DNA matched one of the first fifteen samples.

Suspect Prioritization System (SPS)

Royal Newfoundland Constabulary (RNC) established a Criminal Behaviour Analysis Unit (CBAU) tasked with providing an offender profiling service. This was developed based on well documented academic research which suggested that procedures could be developed which could analyse offender data thereby provide investigators with a list of suspects in a prioritised order. However this system goes further by correlating crime behaviour to offender characteristics [12].

The Information Technology Division of the Constabulary implemented a database, to record data, linked to a MapInfo Geographical Information system (GIS) to visualise the crime patterns. In excess of 7000 Offenders' criminal history was entered into the system and continues to be expanded by the entering of current overnight arrest information. The system generates a report indicating suspect(s) in ranked order

The system although not yet in general use was used to by the originator of the system who had property stolen from his car. The crime was profiled by the system, the 'top' five suspects were investigated and the offender was found to be the third ranked suspect.

Regional Crime Analysis Project (ReCAP)

This project has been implemented by the University of Virginia in Charlottesville along with their local Police departments for use by crime analysts [13]. ReCAP uses a GIS with statistical analysis and machine learning to examine a corporate database that is used by the City and County Police Forces as well as the University. This subsequently allows the rule based system access to relevant information across Police jurisdictional areas thereby

enabling spatial and temporal crime analysis together with forecasting in an unsupervised manner. After approximately three years of development, the system was deployed to the crime analysts during the latter part of 1997. Its effectiveness is still being evaluated.

DOMESTIC BURGLARY SYSTEMS

One area of volume crime that has attracted the particular attention for advanced software technologies is that of domestic burglary. Burglary offences possess special challenges because there are a large number of offences, the same offender is more than likely to commit a series of such crimes and it is rare to have a description of the offender.

Devon and Cornwall Constabulary Expert System

During 1985 a pilot system for detecting domestic burglary offences was developed using a Mimer RDBMS linked to a Prolog interpreter which itself was used as a query language and as an inference engine [14]. A rule-based system was developed which matched crimes using a hierarchical arrangement of *modus operandi* (MO) after separating domestic from commercial offences.

The MO information was gathered from two viewpoints: -

1. The Officer observations at the scene of the crime
2. From a criminal's perspective

and in six sections: - the disposition of the dwelling before and during the offence, the method of entry, how the burglary was executed, the method used to remove stolen items, the items stolen and any special peculiarities.

The MO was codified using a keyword system that represented a path through the data entry form by ticking nodes from root to leaf. An example being: -

[door , front , ground , secure , lock , forced , bodily_pressure]

Approximately 100 crime complaint reports were processed and data entered into the system. The rule base comprised two main components 'detect' and 'extract'. The former used the entire MO set for a crime and constructed prolog terms that constituted effective search branches with the objective to identify the most significant MO's and, therefore, to create an MO for searching against solved crimes. The latter took the created MO and printed a list of criminals whose MO matched various aspects and on what branches the matches were made. The criminals were not ranked in any order but listed in the order in which they were found. The developers established that a criminal's MO remained reasonably constant across several crimes and a weighting between 1 and 5 was introduced to reflect the significance of MO items.

The system was used for three weeks in November 1985 during which extractions were performed on thirtytwo burglaries. As a result a number of weaknesses were discovered the foremost being incomplete and/or insufficient data. The rule base was also enhanced to include the calculation of consistencies in the MO and the perceived significance of an MO, using these in the extraction process.

During the live trial no arrests were made for a burglary offence, however, from the tests made by the developers, indications were that the system had potential for accurately targeting burglars.

The system was subsequently developed further for the Baltimore County (Maryland) Police (BCPD) as ReBES (Residential Burglary Expert System) [15]. Based on 3,800 cases their development produced: - a list of suspects in

ranked order, messages to aid investigators, MO's that identify suspects because of some unique behavioural pattern. If, during the matching process, no match was found or the scale scores too low, the system provided a general profile of the burglar from the characteristics of the crime.

The Devon and Cornwall system never extended beyond the alpha testing stage [16] as the concepts could not be proved. Poor data capture was an issue that was often demonstrated as there were, at that time, insurmountable problems with the amount and type of data collected. A simplistic crime reporting system was installed in the Force between mid 1988 to the end of 1989 abandoning the expert system concept. The ReBES system was also dropped from usage. Reasons given include high turnover in users, new users disagreeing with the knowledge it contained, the volatility of the knowledge used by ReBES, the lack of integration with existing computer systems.

Ottawa Police Service

During 1992 and in conjunction with the National Research Council, the Ottawa Police Service, Canada began development of an expert system to investigate domestic burglaries [17]. Their overall project objective was: -

To develop a knowledge-based system that will assist the police in the investigation of residential break & enter incidents that will illustrate the potential for other applications in support of police investigations.

Eight initial functionality goals were set:

1. provide support for gathering and recording case data,
2. generate suspect characteristics from case parameters,
3. provide the investigator with easy access to:- case parameters, other incidents in the vicinity, similar cases, patrol officer report narrative, witness information, sighting reports, investigators' notes

4. identify the MO of suspects and cleared cases
5. generate a list of possible suspects
6. identify patterns in the area
7. generate reports as appropriate
8. provide a graphics display capability

The system comprised two main components: data gathering/input and analysis. The former relied on a paper-based form completed by an Officer, verified and inputted by an analyst. The latter, a rule based Crystal™ expert system shell supplemented by C language routines for database access.

Alpha testing took place during the end of 1993 with beta testing beginning in July 1994. During the former stage an analyst identified five offences which occurred in the south of the city which had a high probability of being committed by the same person. An offender was arrested and subsequently admitted three of these offences.

This system is now being used by a number of the Canadian Police Forces and is being marketed by a private software company.

Cleveland Constabulary

The current project at Cleveland Constabulary is using a psychological approach to classify offenders of domestic burglaries into the categories of 'Raiders', 'Invaders', or 'Intruders' by examining the relevant variables of each crime. A single variable equates to: - an item of property stolen or damaged; time; date; victim's age; sex; house style etc. There are in excess of 250 such variables, however only about 90 are relevant to distinguishing the above categories. Smallest Space Analysis (SSA), a technique first used by David Cantor [18] in his psychological profiling of criminals, is used to take all of the

crime variables and correlate each against the others thereby discovering similarity ratings.

The results are plotted on a two dimensional graph as illustrated below.

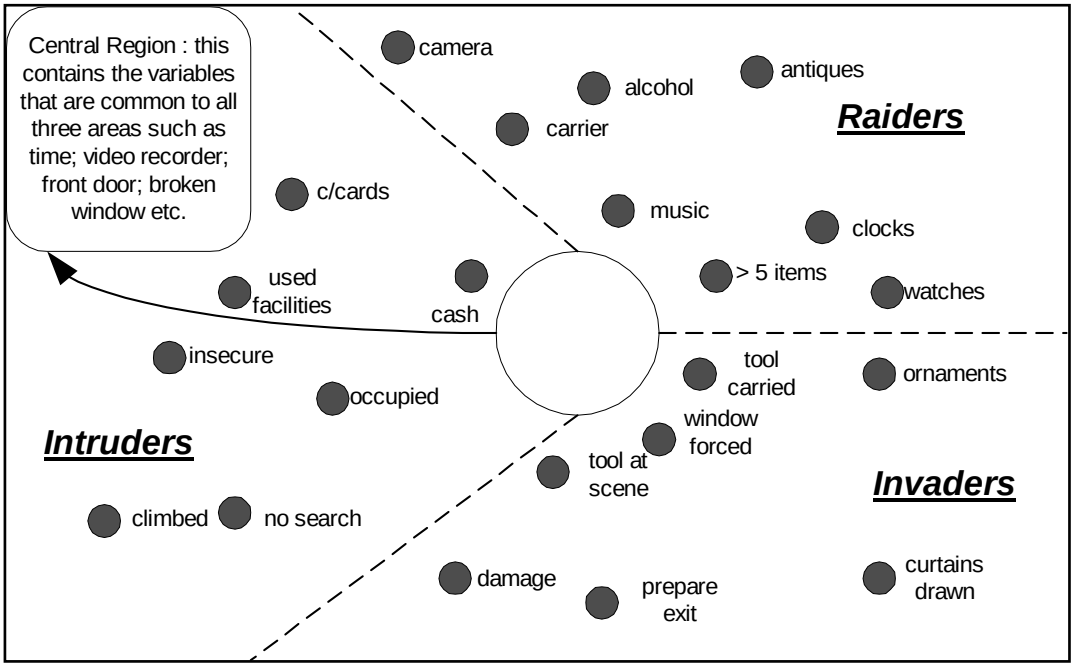

Figure 3. Smallest Space Analysis Chart

THE IDEAL SYSTEM

Can there ever be an 'ideal' single system? The individual systems within this paper have each been designed for a variety of uses within its field.

There is a substantial difference between the requirements for recording and managing crime and its subsequent investigation. Running speculative complex searches on an on-line transaction processing computer will only slow the system and detract from its operational effectiveness, therefore, it is good practice for all data to be transferred into a warehouse for off line processing. Within a warehouse environment it will be possible to amalgamate data from disparate sources i.e. Crime, Command and Control, Custody, Courts etc.; enhance the data by creating new fields based on one or more existing features i.e. banding the time of day that a crime

occurred etc.; and to provide a consistency of data items across the disparate systems i.e. road names etc.

Desirable features

It has been shown how investigation systems are being developed to harness to power of the computer as a tool to aid the solution of both major and volume crimes. The characteristics of those two categories of crime require different treatments. In the case of a major crime series it is necessary to search for connections in two or more crimes when there is a strong prior belief that the same individual(s) committed them. In the case of volume crime it is very hard for even the most sophisticated computer user to pick discernible patterns for linking individual crimes. Identifying characteristics in volume crime where there are no clear suspects is quite difficult due to specific series of crimes being lost in the morass of all reported crimes.

From the stance of investigating crime, there is a set of features that would be most desirable in any computer system, the foremost of which is the ability to interface with disparate, existing systems. It is quite common, at present, to check 4 or 5 different systems to establish the history of and/or intelligence about a single address or person.

“A picture paints a thousand words”; visual representation of information which highlight spatial or temporal connections/patterns is most desirable. Although there are a number of commercially available packages that excel in this area, it is felt that the host system should, itself, be capable of such representation.

The ability to use natural language for queries and the facility for any submitted query having the capability of searching through all tables in the database without the requirement to establish relationship links. This would bring complex

searching into the domain of the untrained user. It would also require a complex indexing system to ensure acceptable retrieval times.

	Ability To Interface	Visual Representation Of Data	Automatic Data Matching	AI Techniques Used
Major Crime Systems				
System				
HOLMES	No	No	No	No
HOLMES2	No	No	Yes	Yes (inference engine)
Interpol	No	No	No	Not Stated
VICAP	No	No	No	No
CGT	No	Yes	No	?
Volume Crime Systems				
System				
CRIS	No	No	No	No
CPAS	Yes	Yes (mapping)	No	No
AIM	Yes	Yes (mapping)	No	No
I2	No	Yes	No	No
Watson	Yes	Yes	No	No
SPS	No	Yes (mapping)	?	?
ReCAP	No	?	?	Yes (rule based expert system utilising statistical analysis)
Burglary Systems				
System				
Devon & Cornwall	No	No	Yes	Yes (rule based system with inference engine)
Ottawa	No	No	Yes	Yes (expert system)
Cleveland	No	Yes (SSA charts)	Yes	Yes (fuzzy logic)

Table 1. System Comparison Table

When data is entered into the system a useful facility would be the automatic matching of any new information to existing information based on user defined criteria. Examples being the entry of current burglary offences; the system could match similar offences based on the MO, geographical area and property stolen and matching robbery offences by offender description and geographical area. The closest matches being displayed with a user defined ‘cut off’ level. The user may require a 90% match on domestic burglaries but be satisfied with a 85% match on robbery offender descriptions.

The table below offers a comparison of the desirable features associated with the systems described herein.

"take in Table 1."

Artificial intelligence (AI) techniques are becoming widely used in a multitude of commercial products and mainstream computer software applications, examples being fuzzy logic controllers and neural network pattern recognition. Similar techniques can be embedded within investigation systems to automatically present results to the investigator.

DISCUSSION

The computer, as a tool, plays an essential part in the investigation of both major and volume crime. The majority of current systems are designed to be used in the investigation of either one of these categories but not both, with the exceptions of i2 and Watson, and have been written to specifically target a niche market. Each system performs well when judged against its intended use. However, the systems mainly rely on users asking specific questions to assist in the investigation process. Specifically within volume crime, the user may not know which question is relevant and, therefore, is unable to efficiently link similar crimes in a series.

In both categories of crime it is left to the human investigator to ask the right questions of the system or to interpret the processed information. This requires increasing sophistication and specialisation to obtain the best results from the software and gain confidence in the procedures. However, this is often difficult to achieve in major crimes due to the relative infrequent occurrence and the voluminous data therefore the honing of such skills is difficult to accomplish. To achieve best results, most UK Forces utilise specialist teams of detective Officers who are supported by trained Civilian Support Staff including trained crime analysts. Such specialism takes time to develop and may vary in the degree of ability with different aspects of crime.

Future systems should now exploit AI techniques that will enable the automatic examination and presentation of information. However, in the past AI systems have been viewed with a great deal of scepticism within the Police Force. This is partly due to a general lack of computer literacy and also due to systems requiring a substantial amount of hand crafted knowledge with which users may disagree or the knowledge becoming dated and difficult to update.

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