The use of forensic science in volume crime investigations: a review of the research literature

Sarah-Anne Bradbury and Andy Feist

Traditionally, the use of forensic science techniques has been concentrated on more serious crimes such as rape and homicide. However, forensic techniques are increasingly being used routinely to aid the investigation of volume crimes such as burglary and vehicle crime. The review summarised here aimed to draw together UK and international social research on the application of forensic techniques to volume crime investigations.

Key points

- The proportion of volume crime offences detected through the use of forensic evidence has, historically, been low. However, the growth of automated searching, alongside new forensic techniques such as DNA and initiatives to improve the attendance rates of crime scene examiners have increased the proportion of volume crime offences detected using forensic evidence.

- Traditionally, forensic evidence has been used principally to ‘corroborate’ evidence against known offenders; however, forensic material is being used increasingly in a way that identifies unknown offenders.

- The presence of forensic material greatly increases the odds of detection where other types of evidence are not available. Overall, forensic material makes the greatest contribution to detecting harder-to-solve crimes.

- The process that determines which crimes receive a crime scene examiner varies widely. First attending officers at the crime scene have generally been found to have relatively low levels of forensic awareness.

- It is estimated that around four in ten of all burglary and vehicle crimes have the potential to yield fingerprints.

- Within crime types, no clear relationship has yet been found to exist between forensic attendance rates and retrieval rates per scene visited. However, other factors, such as integration and communication, have been identified as important influences on retrieval rate performance.

- Automation of forensic databases does not, on its own, guarantee improvements in detection performance.

- Forensic evidence does appear to increase the likelihood of a conviction for certain crime types (including burglary and theft) and result in longer sentences being imposed.
Aims and methodology

The main objectives of the review were to identify:

- the mechanisms by which forensic science is applied to the investigation of volume crime
- the strengths and weaknesses of the use of forensics in the investigation of volume crime
- how forensic science contributes to the effective and efficient detection (and conviction) of crime.

Methodology

Inclusion and exclusion criteria were defined in relation to the aims and objectives of the review. Through database searches and contact with experts, 499 reports were identified in Britain and elsewhere – 50 studies were identified as being relevant to the review. A parallel review by Jansson (2005) explores the more general literature around volume crime investigations.

Overview of the contribution of forensic science to police investigations

A number of general themes emerge from the research literature in terms of the overall contribution that forensics makes to crime detection. Several of these themes point to the changing nature of the use of forensic science in the detection of crime.

Changing contribution of forensic science

Studies that have examined the proportion of offences detected through the use of forensic techniques have revealed that they have, traditionally, made only a small contribution to total detections; most crimes are detected by other means. Even in the mid-1990s, a study of residential burglary in the West Midlands found forensic techniques were used in less than one in five detected burglaries, and perceived as essential to detection in only 6% of ‘primary’ detected burglaries (Coupe and Griffiths, 1996). However, more recent UK studies point to forensics contributing to a greater proportion of volume crime detections - accounting for one-quarter of primary detections (Burrows, Hopkins et al., 2005).

Increasing use of automated searching techniques

Several key studies undertaken during the 1980s highlighted that forensic evidence was principally used to corroborate other evidence against known suspects, rather than for identifying unknown offenders (Ramsay, 1987). The increasing use of automated searching techniques using computer databases for fingerprints, DNA and footwear marks, means that forensic material can increasingly be used to generate first links to crimes as well as providing evidence to secure subsequent detections.

Use of forensics in ‘harder-to-solve’ crimes

In spite of the apparently limited use of forensic material in the detection of volume crime, when physical material is considered against the wider evidential canvas, it is found to make a particularly important contribution in the detection of ‘harder-to-solve’ crimes. Forensic evidence greatly increases the odds of detecting an offence especially when other forms of evidence are absent. The increasing use of forensics as a tool by which unknown offenders are identified will have further strengthened the degree to which forensics assist in detecting otherwise hard-to-solve offences (Peterson et al., 1984).

Abbreviations and terms

- TIC: Offences taken into consideration
- DNA: Deoxyribonucleic acid
- CSE: Crime Scene Examiner/Scenes of Crime Officer
- FAO: First attending officer

In this study, the term forensic science has been used to describe the use of physical material – principally fingermarks, material yielding DNA such as blood and saliva, footwear impressions and toolmarks – that aid the investigation and detection of crime.

What happens at a crime scene

When a crime is reported, decisions are made about whether a CSE should attend. This decision may be determined by force policy (for instance ‘all burglaries will be attended’), or it may be down to the judgement of the first attending officer or the call taker.

The CSE will attempt to collect any relevant forensic material from the scene. Depending on the quality and extent of the material collected, it will submitted for loading on to the relevant forensic database for comparison against the fingerprints/DNA of suspects, or material collected from other offences (to establish ‘scene-to-scene’ links).

Attendance by crime scene examiners at crime scenes

Decision-making and the attendance of crime scene examiners

In terms of who performs the task of crime scene examination, the use of dedicated crime scene examiners (CSEs) is not universal. In the US, responsibility for collecting forensic evidence from crime scenes is often shared amongst CSEs, investigators or patrol officers (Horvath and Meesig, 2001). Policies about the deployment of CSEs range from blanket attendance for certain crime types to discretionary attendance on the basis of information provided to a call taker or by first attending officer (FAOs).

In England and Wales, burglary dwelling attendance rates of CSEs are generally high and in excess of 70%; a smaller proportion of vehicle crimes are attended (Williams, 2004). The most recent data (2004/05) indicate CSE burglary dwelling attendance rates of 85%. Decisions to send a CSE will be influenced primarily by the potential to recover forensic material and the perceived seriousness of the offence.
Research into first attending officer’s (FAO’s) decision-making over CSE attendance has highlighted potential weaknesses in this method of CSE deployment - in particular, low levels of forensic awareness amongst FAOs (Saulsbury et al., 1994). Even where mandatory attendance policies exist, the actual pattern of attendance may fall below what is expected either due to poor communication (Jones and Weatherburn, 2004) or the reluctance of patrol officers to be directed to meet mandatory instructions for CSE attendance (Peterson, 1974).

Variations in crime scene attendance rates

A recurring theme in this aspect of forensic activity is that of police force variations in CSE attendance rates (even allowing for similar crime types). Resourcing and geography have been identified as important factors in determining levels of CSE visits. One study of forensic performance in seven English and Welsh forces noted that, while more CSEs per recorded crime was generally associated with higher proportions of crime scenes visited, not all forces conformed to the expected pattern. Other factors might limit attendance levels. For example, less densely populated rural forces often entail greater distances between scene visits (Williams, 2004).

The retrieval of forensic material

Only one study was identified that had involved observing what crime scene examiners do at scenes, and how they fit into the broader investigative process (Peterson, 1974). In the US police department studied, CSEs were found to be disjointed members of an investigative team, fitting uncomfortably into the more rank-based structure of mainstream policing. There was poor quality control of the work of individual CSEs - investigation reports, the main assessment tool for individual CSE performance, were found to be rarely reviewed. Victims’ perceptions of CSEs were generally found to be positive. CSEs themselves acknowledged that simply spending time with victims was an important part of their wider role. However, other studies have found victims to be critical of ill-considered CSE examinations (Coupe and Griffiths, 1996).

The initial screening of offences for forensic examination makes it hard to establish genuine base rates for the potential to retrieve forensic material from crime scenes. A study which looked at attendance by forensic specialists at 749 unscreened major felony crime scenes (Parker and Peterson, 1972) found that fingermarks were present at similar proportions of burglary dwelling and vehicle crimes (41%), and 45% of non-residential burglaries. The failure of scenes to yield physical evidence was usually due to:

- scenes being cleaned before CSEs arrived
- inaccessible scenes
- minimal disturbance by the offender (Parker and Peterson, 1972).

Variations in retrieval levels

Table 1 summarises selected studies which have included data on volume crime retrieval rates (as a proportion of scenes visited). Most studies of retrieval rates at burglaries have consistently identified fingerprints as the most

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<th>Table 1 Retrieval rates of forensic material (as a proportion of scenes visited), by crime type and forensic material (English and Welsh forces)</th>
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<td>Fingerprints</td>
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frequently retrieved contact trace material, with typically just under one in three residential burglary scenes attended resulting in the retrieval of fingerprints. Data on English and Welsh retrieval rates puts DNA retrieval at 10% of all scenes visited (similar to shoemarks, although these recorded a greater variation between forces).

Relatively high retrieval rates per crime scene visited are generally associated with crimes which are more frequently subjected to selective CSE attendance (screening), such as vehicle crime. Retrieval rates for offences receiving high levels of attendance (such as burglary dwelling) are, by comparison, generally lower. Even when comparing rates for particular forensic material within particular crime types, marked area by area variations in retrieval rates are a common finding. Factors influencing retrieval rates over which the police have influence include the quality of initial advice on preservation; the resources available to examine scenes; the overall demand put on those resources (usually measured in workload), and policies in relation to forensic attendance.

Attempts to explore the statistical relationship between attendance rates and retrieval rates (per scene visited), within particular crime types, have generally failed to find a clear relationship between the two. An analysis of force attendance rates and retrieval rates per scene visited (DNA) for burglary dwelling revealed a poor correlation (HMIC, 2000). In a more limited study in three US forces, Petersilia (1978) found that high attendance rates could result in relatively high recovery rates for fingerprints.

An evaluation of an Australian police operation to increase the proportion of volume crime scenes visited by CSEs (Jones and Weatherburn, 2004), did not generally find an improvement in key outcome measures (including retrieval rates). However, the authors argued for caution in interpreting these findings, due to weaknesses in the original intervention and some of the underpinning assumptions. In summary, the findings from these studies suggest that high attendance rates do not appear to be an impediment to high retrieval rates per scene visited. By the same token, low attendance rates do not appear to be a necessary guarantee of high retrieval rates per scene visited. A range of other factors, such as how scenes that receive a visit are selected, the ability of individual CSEs, the speed of response, resourcing and communication/ integration with police officers, are all likely to be important influences on retrieval rates.

Several qualitative studies of the variations in retrieval rates have highlighted the importance of other factors. Williams’ (2004) analysis of the relationship between resources and retrieval rates indicated that greater resources did not necessarily generate higher retrieval rates across similar crime types. Williams suggests that factors such as the degree of integration and communication between police and scientific support appeared to be important in determining retrieval rates. This echoes the findings of Petersilia (1978) in the US.

The use of forensic material in the detection of crime

Research tracks a marked change in the process by which identifications are made using forensic material. Before automated searching, most fingerprint identifications arose from searches of the database requested by detectives against named suspects (so called request searches). Cold searches, those involving large scale manual searching of fingerprint files were rarely undertaken. Furthermore, performance variations at the front end of the physical material collection and retrieval process were not reflected in performance in identifying suspects (Petersilia, 1978). The most important factor influencing performance in forensic detections was the inclination of detectives to request searches of fingerprint databases. Automation of searching techniques was therefore identified as the critical barrier to improving performance in forensic identifications.

Although the development of automated fingerprint recognition systems has made the process of comparing scene and offender prints, simpler, faster and generally more effective, US studies reviewed suggest that automation does not guarantee improvements in forensic identifications (see box below).

A comparison of two US studies on the effects of automated fingerprint recognition

The contrasting results of two evaluations of the introduction of automatic fingerprint systems in the US (Minnesota and Kentucky) illustrate the point. Minnesota (Coleman, 1980) was generally seen as effective in generating additional fingerprint detections, whereas the benefits in Kentucky (Cordner, 1990) were marginal.

In Kentucky, a combination of a lack of evidence technicians (CSEs), the reluctance of patrol officers to retrieve fingerprints and their failure to submit when they were retrieved, all conspired to produce a very modest improvement in fingerprint identification performance through automation. Furthermore, the particular issue of achieving a high degree of coverage of prolific property offenders within the offender database (that is, those individuals against whom crime scene fingerprints were checked) appeared to play a critical part in the success of automated fingerprint recognition in Minnesota and the failure in Kentucky.

The development of national DNA databases has been an international phenomenon since 1995, although the coverage and scope of each database varies between different countries (Schneider and Martin, 2001). For the DNA National Database in England and Wales, of the annual total of 41,618 crime scenes to which one or more suspects were ‘nominated’ in 2003/04, 60% were for burglary and taking a vehicle without consent.

A study in one English force found that the factors most associated with achieving a forensic identification from a scene visit were:
• the number of exhibits retrieved (the more retrieved the higher the likelihood of a match)
• the nature of the offence
• the individual CSE in attendance (Lanner Group, 2004; Green and Loader, 2005).

Analysis of individual CSE performance found marked variations in terms of their DNA matches/fingerprint identifications per scene visit, likely to be a consequence of differences in working practices between individuals.

The post-identification investigation

Getting an identification from a forensic database does not guarantee a detection. The largest ‘tracking’ studies of forensic identifications in England and Wales suggest that around seven in ten matches/identifications in volume crime cases ultimately lead to detections (Speakman, 1999; Burrows et al., 2005). Forensic detections have, however, also been found to lead to a number of additional detections. On average, Speakman (1999) found that each detection resulting from a DNA match would yield an additional 0.4 detected crimes (through the detection of linked offences). Studies that have explored the failure to turn forensic identifications into detections have identified legitimate access claims and the absence of supporting evidence as the most common problems. A study of DNA matches which resulted in no further action found that more than half of the cases failed to proceed because of the absence of supporting evidence (MHB, 2003).

The contribution of forensics to convictions

In terms of the contribution that forensic evidence makes to convictions, Peterson et al. (1986) found that, overall, the conviction rate for cases with scientific evidence was not significantly higher than those without. However, significant differences were found once crime types were examined individually. The greatest impact on case outcomes at court once other factors had been controlled for was the use of forensics in murder, burglary and theft cases. For burglary, this amounted to increasing the likelihood of a conviction by 20% where forensic evidence was present. One other clear finding was the association between the presence of forensic evidence and longer sentence lengths (Peterson et al., 1986).

More recent studies on rape and homicide (Briody, 2002; Briody, 2004) have applied Peterson et al.’s (1986) approach to the use of DNA in Australian rape and homicide cases. The general picture appears to be that, as with forensic evidence more generally, the presence of DNA evidence is more likely to lead to a case being finalised in court. It also greatly increases the likelihood of a jury’s decision to convict. A similar, even stronger, finding emerged for fingerprints in relation to homicides. The presence of DNA generally appears to be associated with longer sentences (although the reason why this is the case is unclear). A failure to find statistical associations between guilty pleas and the use of DNA may reflect the speed that it took to process DNA samples in the jurisdictions covered by these studies.

Discussion

The social research literature on the application of forensic science to volume crime presents a number of challenges. In some respects, the forensic process is essentially similar to that described in studies of the 1970s and 1980s, but the way in which forensic material can be processed and analysed has been revolutionised through:

• automated fingerprint searching
• DNA technology
• the establishment of related databases.

On these grounds it might be tempting to dismiss the pre-automated fingerprint recognition, pre-DNA research to be of little value. However, these earlier studies allow us to have a much fuller social research perspective on the journey that forensic applications to volume crime has taken over the last 30 years. This relates to:

• the increasing use of forensics to provide the first link to unknown offenders
• the greater application of these techniques to volume crimes.

These earlier studies also continue to provide a helpful overview of the way in which forensics are of value to detections and convictions.

Addressing gaps in the evidence base

Several elements of the forensic process would appear to benefit from further exploration. These include:

• At the very start of the forensic process, the individual performance of crime scene examiners appears to vary; exactly why individual performance differs, or what happens to detection rates if CSEs take on more of the investigative role, is still not clear.
• The poor statistical relationship between forensic attendance and retrieval rates has long been a feature of analysis in this area. Exactly what combination of factors contribute to higher rates of forensic retrieval (and subsequent identification) needs to be more clearly identified.