

Chapter 6

Case Linkage

Identifying Crimes Committed by the Same Offender

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Summary

This chapter begins by explaining the purposes of linking crimes committed by the same offender and what case linkage can add to a police investigation and prosecution. The various steps involved in the process of case linkage are explained. The assumptions of behavioral consistency and inter-individual behavioral variation, which case linkage rests on, are outlined, and the research that has begun to test these assumptions is reported. The effect of poor-quality data on the case linkage process and on empirical research is examined. Current methods and future developments for overcoming this difficulty are described. The obstacles to identifying linked crimes across police boundaries are discussed. Case linkage research and practice are compared with various criteria for expert evidence with promising results. The chapter closes by considering future avenues for research and practice in case linkage.

INTRODUCTION

If a police officer is investigating a rape and the perpetrator of the rape has committed other sexual crimes, there are several reasons why it would be advantageous for all of the perpetrators' crimes to be investigated together. First, this would enable the police force(s) to use their limited resources more efficiently. Investigative efforts can be combined rather than the crimes being investigated in parallel, which would result in the duplication of work. Knowledge about

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the perpetrator or evidence against the perpetrator gathered from each crime scene can be combined (1), which can potentially result in the more rapid apprehension of the suspect or can potentially strengthen the case against them.

Identifying crimes committed by the same perpetrator can be relatively straightforward if the victims know the identity of their attacker. However, if the suspect is a stranger to the victim, then identification can be less straightforward. Physical evidence, such as DNA, can be used to link crimes together committed by an unknown suspect, but in a number of crimes, there is no physical evidence to identify the offender (2). It is in such situations that case linkage can be of use.

Case linkage is a process that aims to identify crimes that are likely to have been committed by the same suspect because of the behavioral similarity across the crimes. Crimes committed in a similar manner are “linked” to form a “series.” In other words, the crimes are linked together because the offender has behaved in the crimes in a very similar way, and therefore, it is probable that the same offender has committed all of these crimes. Evidence that an offender is likely to have committed a group, or *series*, of crimes is not only useful for investigative purposes, as outlined above, but can also be presented as similar fact evidence in legal proceedings (3,4).

Case linkage is typically conducted by crime analysts or police officers. It is sometimes called “comparative case analysis” (5) or “linkage analysis” (3) and has been described as a type of behavioral analysis (2). It has most often been used with crimes such as stranger rape and murder. However, as will become clear later in this chapter, it can be, and is, used with volume crime, such as burglary and robbery.

Previous writers have considered the linking of crimes to be a type of offender profiling, and indeed, expert profilers are asked to link crimes (6). The two approaches do share some common features: for example, both are most often used for crimes committed by unknown offenders. Criminal profiling and case linkage also share the assumption that offenders are consistent in the way that they behave across their crime series. This assumption has been termed the offender consistency hypothesis (7). However, although the two approaches share common features, it is important to recognize their differences. Profiling makes predictions about a person’s (demographic) characteristics from their crime scene behavior. Hence, it requires a relationship between behavior and a person’s (demographic) characteristics. It follows that offenders who share similar criminal behaviors should therefore share similar demographic characteristics. This assumption has been termed the homology assumption (8,9). Case linkage does not, however, make this assumption. The assumptions underlying case linkage are outlined later in this chapter. The next section outlines the process itself.

THE PROCESS OF CASE LINKAGE

There are typically two different scenarios in which a crime analyst would seek to link crimes. An analyst can proactively search for linked crimes among a database of crimes. Alternatively, they can engage in a reactive search having been presented with an index offense (for which the offender might already have been identified) with a request to identify other crimes potentially committed by the same offender. Depending on the purposes for which an analyst has been consulted, the processes involved in the linking of crimes can vary slightly. However, the same general steps will be followed, and these are illustrated in Figure 1.

First, the crime analyst must collate all the relevant information about the crime(s) in which they are initially interested. Typically, the victim's account of the crime is the primary source of information. Clearly, were the victim killed during the commission of the crime, this will not be available.

Victim accounts can be in two forms. The first is a victim statement. This is typically a chronological account of the crime that is written collaboratively with a police officer (10). Alternatively, the crime analyst may have access to the written transcript of the victim's interview with the police (11). In such circumstances, the victim is often asked to freely recall the event and is then questioned further on this. A transcript of an interview is not therefore a chronological account of the event and is likely to contain quite a bit of repetition. As well as consulting the victim's account, the crime analyst may consult other records, such as the suspect's account (if apprehended) and medical examination

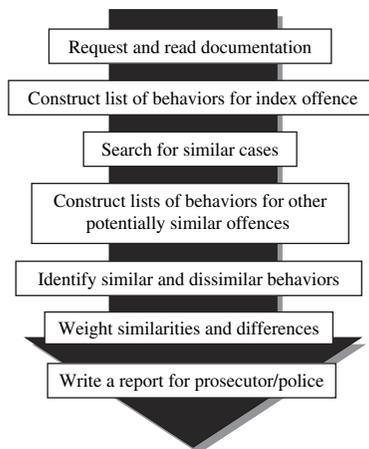


Fig. 1. The process of linking crimes.

reports, or they may choose to visit the crime scene itself. With murder cases, the analyst can consult materials such as crime scene photographs or sketches, the autopsy reports, and toxicology reports (3).

Having collated all relevant information, the crime analyst must compose a list of the behaviors exhibited by the perpetrator. Some behaviors might be more spontaneous, whereas others may be produced as a reaction to the victim or witnesses. In some jurisdictions, as well as creating a list of behaviors, the analyst classifies suspect behaviors as “*modus operandi*” behaviors or “ritualistic” behaviors (3). In these circumstances, the term “*modus operandi*” is used to refer to behaviors that are necessary for the offender to commit the crime, whereas ritualistic behaviors are not and are fantasy-based. Alison et al. (12) explain that *modus operandi* behaviors are “functionally significant” and dependent on context. Whereas, what Alison et al. (12) term “signature” behaviors are “psychologically significant” and are not dependent on context. These are behaviors that seem similar to Hazelwood and Warren’s (3) ritualistic behaviors.

There is a difficulty in referring to ritualistic behaviors as fantasy-based, as fantasy-based behaviors will be more relevant to some crimes, such as sexual crime, and perhaps less relevant to property crimes on which case linkage is still conducted. Terms such as “psychologically significant” and “functionally significant” may be more helpful. However, there are some inherent problems with categorizing behaviors in this way.

First, it seems unlikely that psychologically relevant behaviors are truly context independent. The psychological meaning of a situation is influential in determining the behavior that is displayed (13), and during a crime, the psychological meaning of a situation could change for an offender depending on a number of factors. For example, Davies (14) describes a serial rapist whose behavior toward his victims appeared to vary depending on his perception of their status. The offender was complimentary of a middle-class young female victim, but he physically and verbally abused his other victims, most of whom were older and appeared less affluent.

Second, as recognized by both Hazelwood and Warren (3) and Alison et al. (12), categorizing a behavior as *modus operandi* or ritual/signature requires a subjective decision on the part of the analyst as to the psychological meaning of a behavior. Both sets of authors comment on the difficulty of determining whether a behavior constitutes *modus operandi* or ritual. As an example, the age and sex of the victim in a sexual crime are noted as a *modus operandi* behavior by Hazelwood and Warren (3), and yet, these could quite clearly be related to an offender’s sexual fantasy. Hazelwood and Warren (3) also comment that a behavior could be both *modus operandi* and ritual. The categorization

of offender behaviors into *modus operandi* or ritual/signature therefore has a number of associated difficulties and is perhaps an unnecessary optional step in the case linkage process.

Once a list of behaviors has been created for the crime(s) in question, the analyst's next task is to search for crimes where similar behaviors were displayed. When potentially similar crimes are identified, the analyst must again collate information about the perpetrator's behavior and create a list of behaviors engaged in for each offense. The analyst can then consider similarities and differences in behavior between the offenses. The context in which a behavior occurs is also considered because this can alter the apparent similarity or difference in behavior between crimes. A behavior that initially appears different might be explained by situational influences, such as victim behavior or third party disturbance. For example, apparent differences in the use of physical violence by a rapist could be explained by variations in the victims' resistance. The analyst must in this case consider the context in which violence occurred.

Having identified similarities and differences between crimes, an important stage in this process is to consider the base rates for such behaviors. Two crimes might share a similar behavior, but if the behavior commonly occurs within the particular class of offense (e.g., rape and robbery), this would not strongly suggest that the same offender committed the two crimes. In some jurisdictions, databases of behaviors are available to enable such *weighting* of similarities and differences, whereas in others, the analyst has to rely on their own expertise with a crime type or on the combined expertise of the analyst team. Hazelwood and Warren (3) refer to the analyst identifying the *signature* of an offender or the *unique combination of behaviors* they have engaged in. Although different terminology is being used in the literature, the same point is essentially being made: that this process does not only involve the identification of shared behaviors but that the rarity of such behaviors must also be considered.

Having considered the similarities and differences in behavior between crimes, and the base rates of behaviors, the crime analyst must finally decide whether, in their opinion, it is probable that the same offender committed the crimes analyzed. A crime analyst would not expect perfect consistency in behavior for the reasons outlined above. This point raises the question of how similar two crimes must be before the analyst should give their opinion that it is probable that the same offender committed both crimes. As recognized by Bennell and Canter (5), there are financial and human costs associated with setting the criteria for linking crimes either too low or too high. These issues will also vary depending on whether the analyst's opinion is to be used for investigative purposes or in legal proceedings. Little research has thus far considered this issue; hence, Bennell and Jones (15) have called for researchers

to begin investigating this topic. Recommendations for practice are therefore not possible at this stage until more research is completed; however, interested readers are referred to Bennell and Canter (5), Bennell and Jones (15), and Alison et al. (12) for further information.

The final stage of the process involves the analyst producing a written report for their client in which they can draw their client's attention to similar crimes were any identified. Their clients include police officers, crime analysts from other jurisdictions, and prosecutors. As well as providing a written report, analysts can also be asked to give formal verbal presentations of their findings to the client.

Case linkage requires the crime analyst to process a substantial amount of information, and this can put considerable cognitive load on the analyst (16). Some policing organizations have recognized this difficulty and have developed databases, which the analyst can search for similar offenses (17). Without such resources, the analyst's memory of similar crimes would have to be relied on, which is clearly undesirable. As well as using such databases for searching, some efforts have been made in automating part of the linking process by computerizing the actual comparison of offense behaviors between crimes to produce a measure of similarity for each pair of crimes in the database. The crime analyst can prioritize pairs of crimes with a high similarity score for further analysis. The first author has been working with a UK police force in developing such a system for linking robberies. Such automation does not currently have the capacity to consider the context in which a behavior occurred, and for such reasons, it is unlikely that the process of case linkage could be fully automated.

Such developments in the use of technology have increased the efficiency and potentially the accuracy of the linking process. However, the creation and maintenance of large databases requires considerable input. Information has to be collated for each crime and entered onto the database. Quality assurance procedures are also required to ensure the accuracy of the database. These processes are time consuming, and therefore, the question has been raised as to whether data collection and entry can be focused on a smaller number of perpetrator behaviors. Research is outlined in the section entitled "Evaluating Case Linkage", which is beginning to suggest that this step may be possible in the future.

THE THEORY OF CASE LINKAGE

The use of case linkage in advising and directing police investigations and its potential use as similar fact evidence in legal proceedings requires that it has a sound theoretical basis. The process of linking crimes rests on

two key assumptions. The first assumption is that criminals are consistent in the way they behave across their crimes. In psychology, the assumption that people show consistent behavior across different situations is termed cross-situational consistency (18). However, case linkage focuses on the similarity of an individual's criminal behavior within a crime type (e.g., within robberies or within sexual offenses). This is a special type of cross-situational consistency, termed the offender consistency hypothesis (7).

The second assumption is that there is variation in the way different criminals commit crimes. For it to be possible to link crimes committed by the same offender, criminals must show consistent but distinctive behavior. If offenders were consistent in the way they commit crimes but committed crimes in the same way, then it would be impossible to differentiate the crimes of one offender from those of another. Thus, for case linkage to work, criminals must behave in a stable but distinctive manner. Whether these two assumptions are valid has been the focus of research attention by forensic psychologists in Europe, the United States, and Canada. This research is reviewed in the next section.

EVALUATING CASE LINKAGE

Much of the research interest in whether offenders are consistent in their offending behavior has focused on the more serious types of crime, such as sexual assault (1,19–21) and murder (22). However, studies have also been conducted for arson (23), commercial and residential burglaries (5,15,24), and commercial robbery (25). Although these studies have used different statistical methods, they all have reported a degree of consistency in offenders' behaviors.

Analysts typically consider similarity in individual behaviors across crimes. However, some research has considered whether it is possible to link crimes at the thematic level. For example, in Salfati and Bateman's (22) study, the themes instrumental and expressive are used to describe types of homicide. Although a degree of consistency was demonstrated in themes, in the real world, such a dichotomy is unlikely to be sufficiently discriminating for either criminal intelligence or prosecution purposes.

Some of these studies of offender consistency have gone further and assessed the two assumptions of case linkage simultaneously. They have investigated whether crimes committed by the same offender can be differentiated from crimes by different offenders (5,15,25). Other studies have identified for each crime in their sample the 10 most similar crimes. They have then assessed whether any of the crimes in this selection were in fact committed by the same offender (1,21,23). All such studies have confirmed that it is possible to link crimes and have therefore supported the two assumptions of behavioral

consistency and inter-perpetrator behavioral variation. However, the results also indicate that this process is not perfect and that linkage accuracy appears to vary with crime type. The variation in methods used by researchers can make it difficult to draw comparisons between studies; however, Santtila et al. (21,23) used the same methodology making a comparison between arson and sexual offenses possible. Santtila et al. (23) found a “linked” arson to be in the 10 most similar offenses in approximately only 50% of arsons. Santtila et al. (21) found greater linkage accuracy with sexual crimes for which approximately 60% of the time a crime from the same series was found within the 10 most similar offenses.

Comparisons can also be drawn between the studies of Bennell and Canter (5), Bennell and Jones (15), and Woodhams and Toye (25), which have all used similar methodologies. Measures of predictive accuracy, called areas under the curve (AUCs), were calculated in all three studies using receiver operating characteristic (ROC) analysis. The AUC indicates how well linked and unlinked pairs of crimes were identified. An AUC of 0.50 indicates chance level and an AUC of 1.0 indicates perfect discrimination (26); thus, a larger AUC represents higher predictive accuracy. In Bennell and Canter’s (5) and Bennell and Jones’ (15) studies of burglary, the AUCs ranged from 0.63 to 0.81 and 0.52 to 0.94, respectively. In their study of commercial robbery, Woodhams and Toye (25) report AUCs ranging from 0.70 to 0.95.

Variations in performance *between* studies could be due to methodological differences or could reflect how amenable certain crime types are to case linkage. Consistency might actually be less for some crimes than others, although this has not yet been investigated. The ranges for accuracy reported *within* the studies of Bennell and colleagues (5,15) and Woodhams and Toye (25) reflect the use of different behaviors as predictors of linkage. These studies provide preliminary evidence that offenders show greater consistency in some behaviors used in committing a burglary or robbery than in other behaviors. Greater consistency has been observed in behaviors that are more inherent to the offender and are less influenced by situational factors. For example, the property stolen in a robbery or burglary can be highly dependent on the situation, whereas the offender has greater control over which addresses he or she chooses to target and how he or she will seek to control any witnesses.

If offenders show greater consistency and distinctiveness in some behaviors compared with others, such findings have implications for the collation and entry of information onto crime databases. It would be more time efficient to focus on the collation and entry of behaviors that are more reliable indicators of linkage. These findings also suggest that crime analysts should focus their attention on such behaviors when considering similarities between

offenses. The research is not yet at a stage where clear recommendations can be made for practice; however, it does suggest this will be possible in the future.

Most of the studies of case linkage have focused on testing the underlying assumptions of the process and assessing whether it is possible to link crimes on the basis of behavioral similarity. Only one study (16) thus far appears to have considered how case linkage is conducted in practice. The methods of linking car crimes used by (i) experienced car-crime investigators, (ii) investigators of other types of crime, (iii) inexperienced investigators, and (iv) laypersons were compared using the same 10 solved series of car crimes. Participants' accuracy was assessed, but they were also asked to articulate their method for linking during the process itself and afterwards. As would be expected, experience increased linking accuracy. The accurate linking of car crimes was more often associated with variables such as the type of vehicle chosen and the time and place the crime occurred, whereas the property stolen from the car was a poor predictor of linkage. It appears that the behaviors associated with accurate linking are those that are more under the offender's control, whereas poor predictors, such as the property stolen, are more situation-dependent. These findings mirror those reported in statistical analyses of case linkage and again suggest that more accurate and efficient linking could be achieved if certain predictors over others are focused on. The identification of accurate predictors of linkage is an important research goal for the future.

OBSTACLES TO LINKING CRIMES

Data Limitations

One obstacle to the accurate linking of crimes is the type of data crime analysts must presently work with. As explained in the section entitled "The Process of Case Linkage", it is the victim's account of the crime that is most often used in determining how the offense was committed. It is important to remember that this account is a secondary record of the offender's actions. It is rare to possess a primary record of an offense, such as a closed circuit television recording. However, even where such primary records exist, they do not constitute a complete record of an event: for example, the offender's verbal behavior may be missing. It is therefore likely that crime analysts will always have to rely mainly on the secondary account of the victim.

The accuracy and completeness of a victim's account are likely to be imperfect for a number of reasons. The victim may be traumatized by the event or they may have a poor memory of the event or part of the event (e.g., in the case of drug-assisted sexual assaults). When the victim has a good memory of the event and is able to accurately articulate what occurred, errors or omissions

can still occur at the interview or statement-writing stage. The statement may be taken or the victim interview may occur some considerable time after the offense occurred (12). The collaborative nature of statement writing and the selective nature of investigators' questioning can result in information currently perceived by them as irrelevant for prosecution being ignored and/or omitted (27). Distortion of what occurred is also possible, in that certain features may be suppressed with others being exaggerated (28).

Although they are always likely to contain some omissions and errors, victim interviews are arguably a more accurate record of the victim's account than victim statements because they are a real-time record of the event in the victim's own words. In England and Wales, (tape-recorded) victim interviews are beginning to replace victim statements with the implementation of the Youth Justice and Criminal Evidence Act 1999. This change means that the potential for the introduction of error into the victim's account will be less.

One way for researchers (and crime analysts using automated linkage systems) to deal with potential errors in victims' accounts is through choosing an appropriate measure of similarity for linking. Jaccard's coefficient is a measure of similarity that does not include joint non-occurrences in its calculation. In other words, if a particular behavior did not occur in two crimes, this would not increase their similarity. This point is advantageous if we consider that a behavior may have occurred but that, for the reasons outlined above, its occurrence has not been recorded in the victim's account. This advantage has been noted by Bennell and Canter (5) although it has also been recognized that Jaccard's coefficient has some disadvantages (15).

Because police records are unlikely to be complete records of the event for the reasons outlined above, Alison et al. (12) have warned against using individual behaviors for linkage. Instead, they recommend that crime analysts and profilers use geographical proximity to link crimes because this is more likely to be accurately recorded (12,28). This recommendation appears to be partly based on the findings of Bennell and Canter (5) and Bennell and Jones (15) that, for residential and commercial burglaries, inter-crime distance was the most accurate single-feature predictor of linkage. However, as outlined in the section entitled "Evaluating Case Linkage", some studies have demonstrated the ability to link crimes using other behaviors, such as those behaviors used to control the victim (25). It is perhaps too early in the research process to make such recommendations.

Researchers of case linkage typically begin their data analysis by developing a behavioral checklist from a content analysis of the offenses in their sample. This checklist would capture all of the behaviors in the sample. Each offense is compared against the checklist and the absence or presence of each

behavior has typically been recorded. Poor-quality data can cause difficulties in this procedure. If a checklist contains the behavior “vaginal penetration,” a difficulty arises should the victim’s account solely state that “penetration occurred.” In such a scenario, the researcher is unsure as to the nature of the penetration, and this information is lost from the analysis. Where police forces are moving toward computerized databases of crimes, this issue can also be problematic, and potential links between crimes can be missed. The first author is currently working with colleagues to devise a method of categorizing offending behaviors that could overcome this very real difficulty for researchers and practitioners alike.

Geographical Obstacles

A further obstacle to the linking of crimes relates to the geography of an individual’s offending. Crime analysts often work for a specific police force that only covers its own geographical area. However, criminals do not keep within police borders when offending, they will cross borders and offend in other police jurisdictions. A force analyst searching for similar crimes within their own force’s databases can therefore fail to identify linked crimes that occur in neighboring jurisdictions. For this reason, units conducting analysis at a national level have been established, such as the Serious Crime Analysis Section in England. The sharing of intelligence and good communication between different force analysis units can also help overcome this obstacle.

Obstacles in the Courtroom

Although case linkage can be used to guide police investigations, it has experienced some obstacles in its acceptance in the courts (3). Although expert evidence on the similarity between crimes has been admitted into legal proceedings in the United States (3), some limits have been put on its admittance. For example, in the case of *State of New Jersey v. Fortin*, Robert Hazelwood was not allowed to present his expert opinion as to whether the two crimes were committed by the same offender although he was allowed to testify as to the similarity between the two crimes (3,29). The grounds for this decision were (i) that Hazelwood’s linkage analysis did not have sufficient scientific reliability, (ii) that few people other than Hazelwood’s close associates practiced linkage analysis, and (iii) that it had not received peer scrutiny.

Criteria for the admissibility of expert evidence are not as clear in the United Kingdom and other jurisdictions as they are in the United States, where expert evidence about a novel technique must meet the Daubert criteria (30). These criteria and associated guidelines produced by the Supreme Court of the United States have been outlined (31).

Vrij (31) explains that the first question to be considered when evaluating whether a novel technique will meet the Daubert criteria is whether the evidence has a scientific hypothesis that is testable. The hypotheses underlying case linkage are that criminals are both consistent and distinctive in their behavior. Scientific studies can be conducted using solved crimes to determine whether the offenders known to be responsible for the offenses behaved in a consistent but distinctive manner. It is therefore suggested that the answer to this first question is affirmative.

The second question is whether this proposition of consistency and distinction has been tested. The answer to this question is suggested to be partially affirmative. The hypotheses that offenders are consistent and distinctive have been tested with some crimes. Three studies have suggested that offenders are consistent and distinctive enough for linked and unlinked crimes to be accurately differentiated (5,15,25). Furthermore, five studies have demonstrated that crimes can be associated with other crimes in their series, which would require both offender consistency and distinctiveness (1,19,21,23,24). Such research has ecological validity; therefore its findings should be relevant to practice. However, it is important to recognize that the samples used in this research consist of solved cases, whereas case linkage, in practice, is used with unsolved cases. As noted by Bennell and Canter (5), such cases might actually have been solved because of their greater behavioral similarity. This issue is problematic and it would be difficult to overcome this limitation; however, one solution would be to conduct research with samples of unsolved crimes that had been linked through DNA testing. To strengthen further the affirmation to this question, cross-validation studies would be required as well as studies assessing other types of crime.

The third question is "Is there a known error rate?" It is suggested that the answer to this question would also be partially affirmative. Studies such as those of Bennell and colleagues (5,15) and Woodhams and Toye (25) have used logistic regression and ROC analyses, which enable overall estimates of error to be calculated on samples of solved cases. These studies have indicated that predictive accuracy rates can be as high as 90% or represented by an AUC in ROC analysis of 0.95 with an area of just 0.05 for error. Although some crime analysts do rely on statistical analyses to aid them in making decisions as to whether crimes are linked, this is not always the case. Crimes would also not be linked purely on the outcome of a statistical analysis. A crime analyst would be involved in making this final decision, potentially in light of additional information. How the subsequent input of an analyst would affect accuracy and how accurate analysts are at linking crimes without computational aid require testing.

There are no known field studies of the accuracy of case linkage. Thus far, the closest to this would be Santtila et al.'s (16) study of the linking of car crimes; therefore this is clearly an area for future research. However, establishing real-world error rates will always be problematic. To determine whether the decision to link a pair of crimes was correct or incorrect, the perpetrator has to have been convicted for both crimes or DNA evidence of linkage would be required. First, it should be noted that conviction cannot be considered a perfect indicator of identity as miscarriages of justice do occur. Second, were conviction considered a reliable indicator of identity, the conviction rates for some crime types for which case linkage is most commonly used are notoriously low, namely sexual crimes (32,33). Third, with regard to DNA evidence, as noted above, often no such evidence exists (2). It is therefore highly probable that in the real world, analysts will make predictions about linkage, yet whether these decisions are correct or incorrect will be impossible to establish.

The fourth question of "Has the hypothesis and/or technique been subjected to peer review and publication?" would also have an affirmative answer. However, it is suggested that the answer to the fifth question, "Is the theory on which the hypothesis and/or technique is based generally accepted in the appropriate scientific community?," would be "not yet." It is suggested that case linkage has not yet received sufficient academic interest; therefore the answer to this question lies in the future. In summary, case linkage evidence does not yet appear to meet all criteria set out in the Daubert ruling.

In England and Wales, expert scientific evidence is not required to meet the full Daubert criteria. Instead, in recent cases, it has been required that evidence has general acceptance in the scientific community. In other cases, evidence based on novel techniques has been admitted but accompanied by a warning from the judge as to how such evidence should be considered by the jury (30).

Ormerod and Sturman (30) have specifically considered the likelihood that case linkage evidence (or as they term it comparative crime scene analysis evidence) would be accepted as expert evidence. They conclude that it is quite possible that evidence of behavioral similarity and distinctiveness would be accepted by the courts. They explain that the purpose of such evidence is to prove similarity rather than proving a suspect's guilt. Therefore, if the method used was considered reliable, if the evidence was unlikely to distract the court (i.e., the jury) unnecessarily, and if it was not rejected for being prejudicial, such evidence could be considered legally relevant. However, they caution that even if such evidence were considered relevant and admissible, it may be rejected for other reasons. These reasons could include if the witness were not considered suitably qualified to be granted expert status, if the evidence

were considered within the experience and knowledge of a layperson, and if the evidence was considered unreliable.

The second of these points, that is, whether the experience and knowledge of a crime analyst about similarities and differences in criminal behavior is outside that of the layperson, warrants discussion. It could be argued that very clear similarities in criminal behavior across crimes would be obvious to the layperson and hence the evidence of a crime analyst would be unnecessary. However, it is important to consider whether the layperson will know which behaviors are actually rare or common in a population of crimes. Crime analysts can have read thousands of crime reports and hundreds of victim statements. Therefore, they will arguably be better informed as to which behaviors are common or rare than the layperson whose knowledge of a type of offense may be based merely on media portrayal or on their limited personal experience. In addition, the crime analyst may have used more objective measures of base rates in determining commonality or rarity through consulting crime databases, which hold information on thousands of crimes, to which the layperson would not have access.

In the sister field of criminal profiling, factions have arisen over the most appropriate way to conduct profiling. This has been termed the clinical versus the statistical debate. Ormerod and Sturman (30) explain that because profiling varies with regard to what it actually is and how it is conducted, it may not be considered admissible in legal proceedings. For case linkage evidence to be accepted by courts, it is crucially important that it receives scientific research attention and has a sound theoretical underpinning. Its acceptance as expert evidence would also be aided by standardization in the way in which it is conducted. As outlined above, although small differences seem to exist in the process, from what has been published, the basic underlying steps appear the same. However, there does appear to be some variation in its practice, as, for example, in the use of statistical methods and computerization in linking.

Thus, in summary, there are obstacles to case linkage in relation to (i) the data that the practitioners and researchers must rely on, (ii) overcoming police boundaries, and (iii) the acceptance of case linkage evidence in courts. There are a number of ways in which these issues can be addressed, as outlined above, and these will no doubt be the focus of future empirical research.

THE FUTURE OF CASE LINKAGE

Theoretically and empirically, case linkage has started with a good grounding. Research seems to be supporting its underlying assumptions. The future for research in this area will include studies investigating the validity

of these assumptions with previously untested crime types. In addition, cross-validation studies are required before existing findings regarding criminal consistency and distinctiveness can be fully accepted.

Empirical research is suggesting ways in which the process of linking crimes could be improved. For example, it appears that some offender behaviors are more reliable indicators of linkage than others. However, further research on this is required before any firm recommendations can be made to practitioners. As research continues into case linkage, it is likely that reliable statistical methods for linking crimes will be developed. These methods have the potential to reduce the cognitive load placed on the analyst and will be more reliable and scientific. They may also encourage standardization in the way case linkage is conducted. They will, however, require the development and maintenance of large-scale databases of crimes. The high standards demonstrated at some crime analysis units such as the Serious Crime Analysis Section in England could be considered best practice for the future establishment of such databases. The development of such databases also holds the potential for calculating base rates of behavior, providing the analyst with a more reliable method of weighting behavioral similarities between offenses.

A number of these potential future developments also have implications for the acceptance of case linkage evidence in legal proceedings, because they will encourage standardization and reliability. However, to remove the analyst from the process of case linkage in the pursuit of standardization and reliability would be an undesirable development. The findings of the linking process will always need to be considered in light of other information uncovered during the investigative process (25), thus it is likely that the professional expertise of the crime analyst will always be required.

The published empirical research has clear implications for the conducting of case linkage. However, the results of such research must be balanced with the practical application of the findings in the real world so that evaluative research will be needed to ensure that recommendations are workable in practice. In the absence of a large pool of research on case linkage, practitioners have been cautious in its application and have been mindful in allowing researchers access to their data for their practice to be independently researched and scrutinized. The cooperative and reciprocal relationship that has thus far existed between academics and practitioners will no doubt continue through joint enterprises. The interested researcher will certainly not struggle to find a topic to pursue: they will be contributing to a novel field with important practical implications for both the policing and prosecution of crime.

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