Executive Summary

- We believe that crime linkage, as a type of forensic science, is making an important contribution to the delivery of justice in the UK.
- Considerable research efforts have been invested in evaluating the reliability of the principles underpinning crime linkage. The principles are largely supported; however, research findings indicate crime linkage decision-making will not be error-free.
- In the UK, there are clear operational standards for the practice of crime linkage at a national level with serious sexual crime; there are not similar standards in place for volume crime. While there may be pockets of good practice, we believe there is a need to establish national operational standards for crime linkage with volume crime.
- Research on legal actors’ understanding of crime linkage is very limited and this is a key gap in evidence.
- Considerable efforts have been invested in creating strong practitioner-academic networks in this field and, therefore, there is great scope for collaboration to further strengthen the scientific basis of crime linkage.
- Such work is inherently interdisciplinary and involves academic-practitioner collaboration. Research funding opportunities need to facilitate such collaborative efforts.

1. Introduction
1.1. Crime linkage is a type of forensic behavioural science. This submission is made following confirmation from the Select Committee that this meets the remit of the call for evidence. While all questions retain the phraseology of referring to “forensic science”, our response deals specifically with crime linkage.

1.2. Crime linkage is the process of identifying series of offences on the basis of similarity and distinctiveness in offender crime scene behaviour (i.e., that offenders repeat elements of their behaviour from one crime to the next and that the behaviour of one offender is identifiably different to that of another offender). In the UK, it is also known as comparative case analysis and case linkage analysis.

1.3. Crime linkage is often used to identify crime series in the absence of physical forensic evidence (e.g. fingerprints or DNA), however, it can be used in conjunction with such evidence where the strength of the evidence is weak or where crime linkage holds additional investigative or evidential value.

1.4. In the UK, crime linkage is conducted at a national level for the most serious types of crime by employees of the National Crime Agency (NCA), in a dedicated unit called the Serious Crime Analysis Section (SCAS). This
unit uses the Violent Crime Linkage Analysis System (ViCLAS\(^1\)), a computerised database especially designed to assist with the linkage process.

1.5. The UK’s Behavioural Investigative Advisers (BIAs), also based in the NCA, conduct crime linkage. Their focus is on serious offences usually containing a sexual element (although they do conduct crime linkage on other types of serious crime).

1.6. Both SCAS analyst and BIA are considered expert roles, and there is intensive training and structure around how crime linkage is conducted, as well as formal procedures for requesting their assistance by officers.

1.7. While there are dedicated national units conducting crime linkage in the UK, crime analysts working for individual police forces also conduct crime linkage as part of a broader analytical role. Their focus is more often on volume crime such as burglary and car theft\(^2\).

1.8. A landmark legal case in Scotland pertaining to the admissibility of crime linkage evidence (HMA v. Ross Young) is cited in the Forensic Science Regulator’s legal obligations document. Evidence given by Professor Woodhams in this case is discussed further below.

1.9. The authors of this submission are world leaders in the field of crime linkage. They have an extensive research history in this area and collaborate with other academics and practitioners of crime linkage at an international level. Professor Woodhams founded the Crime Linkage International NetworK (C-LINK) and Drs Tonkin and Burrell are also founding members.\(^3\)

2. **Is forensic science contributing to the delivery of justice in the UK?**

2.1. Crime linkage is practiced at a variety of policing levels (local to national) and is used to inform police investigations. In other countries, it is used in prosecutions (e.g. in South Africa)\(^4\). Therefore, it is making a significant contribution to the delivery of justice in the UK and overseas.

**Understanding and Use of Forensic Science in the Criminal Justice System**

3. **What is the scientific evidence base for the use of forensic science in the investigation and prosecution of crimes? Are there any gaps in that evidence base?**

3.1. Crime linkage is underpinned by two key theories; that offenders will be consistent in their crime scene behaviour over time, and that each offender will commit their crimes in a relatively distinctive way. Both theories have to be valid for crime linkage to be accurate in practice.

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\(^1\) Collins et al. (1998). Full details of citations are provided in Appendix 1.


\(^3\) Short biographies of the researchers are provided in Appendix 2.

\(^4\) Labuschagne (2006).
3.2. A 15-year body of research has assessed the validity of these two assumptions with crimes of different types (e.g. sex offences, murder, burglary, arson, robbery, and vehicle theft\(^5\)).

3.3. The research studies assess how accurately crimes by the same offender can be identified based on similarity in crime scene behaviour (modus operandi, geographical proximity, and temporal proximity).

3.4. The general findings are that both theories are upheld for the majority of offenders, but not all. In these scenarios, either the offender's behaviour is too inconsistent from one crime to another, or it is not sufficiently distinctive to enable it to be differentiated from the offending of other individuals.

3.5. These research findings need to be considered alongside a number of caveats which were given explicit consideration in HMA v. Ross Young. The evidence given by Professor Woodhams in this case was oriented around the Daubert criteria\(^6\) since she and colleagues have often used this as a benchmark for assessing the scientific standing of crime linkage (see Woodhams et al., 2007).

3.6. Key caveats were: a) the sample sizes used in research studies are small and do not reflect the size of data within which practitioners must search for crime series; b) the statistical methods used by researchers to test the underlying theories do not replicate how practitioners make linking decisions; and c) research often uses samples of crimes consisting of solved crime series, whereas in practice analysts will search for links within samples that contained solved and unsolved, one-off and serial crimes.

3.7. In 2014, the Crime Linkage International NetworK (C-LINK) was founded by our group and other overseas colleagues. A key aim of the new network was to conduct a large-scale study of serial sex offences to overcome a number of the limitations associated with previous research on the theories of crime linkage (as outlined in HMA v. Ross Young).

3.8. We amassed the largest, most ecologically valid dataset of sex offences with which to test the theories to date. Our findings were similar to our previous work; overall, the underpinning theories were robust, but they did not hold true for all offenders all of the time. It must, therefore, be acknowledged that some mistakes will be made in crime linkage predictions (both false alarms and misses\(^7\)).

3.9. While this large-scale study made vast improvements to research methodology, the sample studied (2,500+ UK sex offences) only represents approximately one tenth of the offences stored on the UK ViCLAS database.

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5 Davies et al. (2012); Salo et al. (2012); Tonkin & Woodhams (2017); Tonkin et al. (2017); Woodhams & Labuschagne (2012); Woodhams & Toye (2007). These represent a selection of research studies on crime linkage.


7 False alarms: where cases are deemed linked when they are, in fact, unlinked. Misses: where links between crimes are not identified.
and ideally the study should be replicated with the entire dataset held and used by SCAS. Further, tests of the underlying assumptions with large datasets of other types of serial crime have not been conducted; a clear gap in the evidence that needs to be filled.

3.10. In contrast to the volume of research on the theories underpinning crime linkage there is very little research on how it is practiced. There are important considerations for its scientific evidence base that relate specifically to its practice. For example, only three studies exist on the reliability with which crime analysts can enter data about sex offences onto systems like ViCLAS. Two studies in Canada investigated this issue; coding reliability was found to be variable, and generally poor. More recent research conducted in Belgium found much better coding reliability (where analysts work in a centralised unit similar to SCAS which is different to the structure used in Canada). There are no such studies with volume crime.

3.11. Studies of crime linkage decision-making and accuracy are very limited; there are a few experimental studies, but they bear limited resemblance to any real-world crime linkage task due, amongst other things, to their use of much simplified case materials. Improvements to research methodology are starting to be made and a much deeper understanding of crime linkage practice and decision-making is developing.

3.12. There remains, however, a gap in knowledge of when, where, and how crime linkage is utilised to support ongoing police investigations (particularly with regards to the linking of volume crime). It is also unclear whether nationally agreed standards exist to govern crime linkage with volume crimes (or whether standards function at a more local level). An audit of these issues would help fill this gap in knowledge.

4. How can the Criminal Justice System be equipped with robust, accurate and transparent forensic science?

4.1. It is our collective view that SCAS and the NCA’s BIAs are best placed to provide the highest quality of crime linkage to investigations and prosecutions (if appropriate) for sex offences. This is because they have access to the most comprehensive dataset of sex offences to support their decision-making, and stringent recruitment, training, and quality assurance procedures. If UK Policing were to lose this capability, our concern would be that crime linkage would be conducted on sex offences in a manner which would not adhere to their high level of operational standards.

4.2. Regarding non-sex offences, a number of gaps in our knowledge were noted in paragraphs 3.9 and 3.12. A national survey of crime linkage practice with volume crime would provide a basis for establishing good

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8 Bennell et al. (2012).
9 Martineau & Corey (2008); Snook et al. (2012).
10 Davies et al. (submitted for publication).
11 E.g. Bennell et al. (2010); Santtila et al. (2004).
13 Davies et al. (2018).
practice guidelines relating to the training, use, and management of crime linkage in the UK. Such guidelines would help to ensure more robust, accurate, and transparent crime linkage with volume crime in the future.

5. **What is the level of understanding of forensic science within the Criminal Justice System amongst lawyers, judges and juries? How can it be improved?**

5.1. A few studies have investigated the perceptions that (mock) jurors hold of crime linkage evidence and how they use (or don’t use) it in their deliberations. These have produced concerning findings regarding people’s misperceptions of victim and offender behaviour during sexual crimes; for example, overestimating how frequently rapists enact certain violent or sexual acts, and overestimating active resistance by victims.

5.2. Crime linkage can speak directly to these issues, and practitioners can provide statistical evidence that might combat such misperceptions.

5.3. Existing studies have focused on sexual crime and need replication with other crime types.

5.4. There is no study to date on prosecutorial or judicial understanding of crime linkage or how crime linkage might inform decision-making by these legal actors. We believe this is another important area for future research.

5.5. We would recommend a collaborative approach to improving the understanding of legal decision makers. Academics would be well placed to impart knowledge regarding the scientific underpinning of crime linkage, and practitioners would be well placed to impart knowledge regarding their working practices and operational standards. Such training could be coordinated by the College of Policing.

**Standards and regulation**

6. **Is the current market for forensic science in England and Wales sustainable? Are changes needed to ensure forensic science provision is maintained at the level required? What are the risks of a market approach, for example what happens if a provider goes out of business? And what is the impact on quality?**

6.1. Our responses within section 4 cover several of the issues raised here regarding crime linkage. We believe there needs to be an assessment of the provision of crime linkage in England and Wales, and an important aim would be to develop agreed minimal operational standards.

6.2. Were UK Policing to lose SCAS’ and the BIAs’ provision of crime linkage, this would have significant, negative ramifications on the provision of this type of forensic science evidence.

6.3. Austerity cuts and reductions in analyst numbers across the board are likely to have negatively affected the ability of police forces to produce analytical products, such as crime linkage.

14 Charron & Woodhams (2010); Fawcett & Clark (2015); Sleath & Woodhams (2014).
6.4. Crime linkage has several potential benefits to policing and justice, including improving access to justice for victims, targeting high harm offenders, and the more efficient deployment of limited police resources. Assuming that crime linkage is accurate and robust, a reduced capacity in this area would negatively affect these outcomes.

7. **Is the system of accreditation working successfully to ensure standardised results and the highest quality analysis and interpretation of significance of evidence?**

7.1. There is no system of accreditation for this type of forensic science evidence. However, some providers already have high standards of operation (e.g. the NCA).

8. **What lessons can be learned from the use of forensic science in Scotland and Northern Ireland? What can be learned from the use of forensic science overseas?**

8.1. Crime linkage is practiced internationally, and specialised units exist in many countries to support this form of analysis, including units in North America, Canada, South Africa, Japan, Australia, New Zealand, and across mainland Europe. Many of these units have been operational for years and have staff with decades of experience analysing offender behaviour. As such, there is considerable scope for sharing good practice that can significantly enhance crime linkage practice in the UK. One aim of C-LINK was to facilitate such exchange.

8.2. Through C-LINK we are aware anecdotally of the differences in practice between sexual violence linkage units in different countries, and a more focused investigation of crime linkage practice across countries would undoubtedly generate significant new knowledge that could be used to enhance criminal justice practice in the UK.

8.3. For non-sexual crime, individual academics are seeking and obtaining funding for network building, but this is very much driven by the collegial attitude of the individual researcher and their success in obtaining funding, rather than there being the financial support for a concerted effort to replicate what has been done to date with C-LINK.

**Forensic Science research landscape**

9. **How should further research funding for forensic science be justified? What should be the focus of such research?**

9.1. Accurate crime linkage can generate new investigative leads, assist in the apprehension of offenders at the earliest opportunity, ensure that more offences are attributed to them, and that the evidence available to prosecute them is maximised\(^{15}\). This not only protects future potential victims, but ensures greater access to justice for existing victims. It focuses attention on the highest harm individuals and helps the police deploy limited resources most efficiently.

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\(^{15}\) Ashmore-Hills, Burrell, & Tonkin (2017).
9.2. In purely monetary terms, the Home Office (2011) estimated the cost of rape to be £96,000; therefore, there is the potential to make considerable savings by investing in crime linkage.

9.3. Our suggestions for the focus of future research are covered in previous sections 3.9, 3.12, 4.2, and 5.4.

10. What is the role of UK Research and Innovation (UKRI), especially considering the interdisciplinary nature of much forensic science?

10.1. UKRI has an important role to play here. Future research into crime linkage and its provision should represent excellent science and can have significant real-world impact.

10.2. Such research is inherently interdisciplinary; therefore, there needs to be more support for interdisciplinary research than spans the traditional research councils. There are UKRI funding opportunities that don’t restrict by discipline but there needs to be more of this. The recent cross-council initiative on mental health is a good example of good practice to support interdisciplinary research, and it is easy to see how a similar scheme could be focused on forensic science.

10.3. Innovations and improving operational standards in practice require collaboration between academics and practitioners, and the reduction in funding schemes for networking and collaboration has not helped in this respect. Schemes such as the ESRC’s seminar series and network building grants were an important enabler, and the recent Network Plus call for mental health is another example of the type of scheme that would help in the area of forensic science.

10.4. From our experience, funding for secondments into practice environments also result in effective knowledge exchange, strong networks, and responsive research. More funding for secondments via Impact Acceleration Awards would be welcome, as would specific provision being made for secondments within standard grant applications.

11. Where are the gaps in research and understanding of forensic science? How and by whom should the research questions be articulated to fill these gaps?

11.1. The gaps we have identified are outlined above in sections 3 and 5. We strongly believe that research questions should be articulated via partnerships between practitioners, academics, and policy makers.

12. How can a culture of innovation in forensic science be developed and sustained?

12.1. There are two fundamental elements required: (1) collaboration between criminal justice practitioners, policy makers, representatives from industry, and academics from a range of disciplines; and (2) funding to resource these collaborative efforts.

12.2. Innovative and effective crime linkage methods cannot be developed without the input of experts from a range of disciplines, including psychology, criminology, computer science, and economics. Furthermore,
the input of practitioners and policy makers is vital to ensure that
developed methods meet the needs of those working within the criminal
justice system. Likewise, industry may be important in the future in terms
of building systems that can support more effective crime linkage decision-
making.

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Appendix 1 – References

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