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Review of Hierarchical set up of Central Forensic Science Laboratories

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Abstract:

In forensic genetics, the interpretation of the findings of forensic genetic studies based on activity level proposals is a new field. Even though it has a lengthy history, it has never been deemed as crucial to the profession as it is now. When it comes to providing expert testimony, forensic biologists are increasingly needed to offer their specialized expertise to assist their clients understand how and when evidence was transferred and how it was maintained in court. This means that scientists have an important role in evaluating their results in the context of the situation. An activity-level inference can be made by the judiciary using proper case assessment and interpretation respecting the hierarchy of propositions (supported by the use of Bayesian networks as graphical models), as well as appropriate data to inform probabilities and international reporting guidelines. As shown by this critical evaluation of current research, evidence interpretation is possible when propositions of interest are at the 'action level' with appropriate training and quality assurance conditions.

Keywords: forensic science, interpretation, pre-assessment, Bayesian networks,

Introduction

More than any other issue, population genetics and statistics have loomed large in the DNA discussion of the past decade. In the future, the focus in court will move from "whose DNA is this?" to "how did this person's DNA get here?" As DNA profiles can be generated from ever-smaller amounts of DNA, these types of concerns evoke the typical forensic considerations of recovery, transference, persistence, and contamination. DNA amplification from a single cell is now a reality. In this work, we demonstrate how two specific logical reasoning aids might help to clarify inferential concerns that arise as a result of these exciting discoveries. The Forensic Science Service's Case Assessment and Interpretation (CAI) initiative, which has been underway for the last three years, gave rise to the first of them, which we refer to as the hierarchy of proposals (FSS). Proposals have been generated by the project, and we'll go into

more depth about the notion of the hierarchy of propositions, which is described in detail in the second and fourth of these. Second, we will address Bayesian networks, which have been presented in a previous study in this journal and in this paper, we demonstrate the use of Bayesian networks software in two case studies.

The Hierarchy of Propositions

There is no way to understand evidence without considering at least two competing theories, and this idea is embodied in the hierarchy. These are typically the prosecutors' and defense attorneys' points of view. Propositions of this kind will be considered by the jury in court.

- The defendant raped the victim
- The victim was raped by some unknown person

We call these propositions at the Offence level for obvious reasons: this is the third or highest level in the hierarchical system.. The expert witness will frequently have to answer arguments at the second or activity level, for example, if the expert witness is called to testify on something that is outside the scope of his or her expertise.

- The defendant is the person who smashed the window
- The defendant has never been at the scene

In order to investigate activity level claims, a scientist will need a body of information on the claimed occurrence and the statements made by the suspect/defendant (if any). This is known as the framework of circumstances. In this case, the first premise is based on the fact that the window was shattered by a man, and the second assertion is based on what the defendant claims—that he was never at the site. For example, if a defendant subsequently confesses to being at the crime, but claims to be an innocent bystander, the second proposition might alter since the framework has changed. The context in which the evidence is interpreted also has an impact on how it is interpreted. Whether or whether there is enough matching glass on the defendant's clothes, for example, depends on a variety of variables, such as how large the window was and where it was located, as well as when the clothing was collected for inspection after it was allegedly broken. Transfer and persistence are important considerations for the scientist to keep in mind while working with such high-level hypotheses. These challenges can

only be addressed if the framework offers so little information that the scientist must resort to what we term Level or Source level statements, such as:

- The glass recovered from the defendant's clothing came from the broken window
- The glass recovered from the defendant's clothing came from some other source.

In this study, we are focusing mostly on propositions at this level, which describe behaviors that are alleged to have occurred as part of the defense or prosecution's account of the event. The action in issue in a rape scenario would be the sexual activity that is a component of the case put up by the prosecution. If the defense argument is one of consent, then the same action would be admissible in court. DNA findings would be of little use if both parties had agreed to this. When various times are claimed, persistence issues must be taken into account. Aid in the investigation) For example, the accused had sex with the victim vs 'The accused just socially connected with the victim' are instances of contradictory activity level claims. Defense proposals that may be considered include 'The accused aided the victim in getting into bed, or the victim wore clothing lent to them by the accused. Depending on the specifics of the situation, any number of different activity levels could be appropriate.

The recovered DNA is the product of primary transfer vs The DNA is the result of secondary transfer (or 'The recovered DNA is the result of contamination)' are not activity level propositions as interpreted under this framework. To call such statements "propositional" is an understatement. To begin, they incorporate facts into hypotheses that are then developed further (i.e., the finding of DNA is part of the proposition). Second, they mistake the reality of transfer (i.e., a variable that influences the assessment) with the stated activities of interest. By definition, activity-level propositions must identify the purported acts they describe (by a person). The scientist's appraisal of results given activity level propositions takes into consideration uncertainty regarding transfer, but it does not identify competing propositions in the first place. Since scientists can't testify in terms of Equation mentioned above, which is the probability of the evidence given the proposition, they are most likely not able to "(...) assess whether they [the DNA profiles] originated either through primary or secondary transfer, and indicate the likelihood of their chosen answer (definitively primary or secondary transfer). As a result, the person receiving the expert knowledge may mistakenly perceive their viewpoints on transfer events as findings on opposing hypotheses of activity level.

Furthermore, 'pseudo-activity' assessments that state things like the person of interest was in recent communication with the victim' might raise some red flags. Pseudo activity levels are those that suggest an activity, but only if they are limited to considerations of analytical features (i.e., limiting consideration to an evaluation given source level propositions), and omitting considerations such as the transfer of analytical features, persistence and background. Additionally, the usage of ambiguous terms like "recent" and "contact" exacerbates the problem. The provenance of the inspected content is questioned at the source level. Blood, semen, saliva, and other types of biological material, such as in forensic genetics, are common sources of DNA evidence. Courts have a tendency to dismiss intermediate association ideas because they don't directly relate to the issues that matter most to the public at large. Proposals like "The accused aided the victim to get into bed" and "The accused had sexual intercourse with the victim" are examples of activity level proposals that might lead to a disagreement over the cell type from which recovered DNA was retrieved. The accused's sperm is found on the sample vs the accused's trace cellular material is present on the sample' might be considered the source level propositions referring to an intimate swab of the victim. Because of this, it is not possible to establish propositions below the activity level until some results have been gathered, which is evident from the propositions (or risk being unsuitable). Given the aforementioned source-level assumptions, evaluating the results in the absence of genetic material would be pointless. However, even if no genetic material was detected, activity level proposals may still be used to evaluate the data.

Review of literature

(Beebe et al. 2004) studied “A Hierarchical, Objectives-Based Framework for the Digital Investigations Process” revealed that, despite the fact that digital forensics investigations might vary greatly in their intricacy, each investigation must follow a strict route. Frameworks that have been developed in the past tend to concentrate on the abstract rather than the specifics of research. We believe that although these frameworks are beneficial for conveying broad ideas, more specific information is needed to help researchers and investigators. As a result, we suggest a hierarchical structure for digital research. Our framework comprises sub-phases that may be applied to different levels of abstraction dependent on their aims.

(Ribaux, Crispino, and Roux 2015) studied “Forensic Intelligence: Deregulation or Return to the Roots of Forensic Science” discovered and through a historical, operational, and intellectual perspective, this study provides an overview of forensic intelligence. Because of advances in the capacity to track human activity, police theory, and new technological tools, the field should be considered as an opportunity for forensic science to help police work become more "scientific" in the broadest sense possible. As outlined in this article, an updated framework for using forensic case data to enhance police operations, aid in decision-making, and promote openness is being developed. Even if the phrase 'intelligent' is misunderstood, it is maintained that scientific information, the trace, should be prioritized rather than excluded from present arguments. Ultimately, the development of a contemporary notion of forensic science is enabled by forensic intelligence.

(Evett et al. 2002) studied “Interpreting small quantities of DNA: the hierarchy of propositions” Fore- sic research has been forced to face more interpretational issues because to the tremendous growth in DNA profiling system sensitivity in recent years. There has been a lot of debate over questions like "who's DNA is this?" but now it's evident that the focus is changing to questions like "how did this DNA get to be here?" In this pay-per, fresh insights are supplied by two recent developments in the field. This includes a study called Case Assessment and Interpretation (CAI) in the British Forensic Science Service (BFS) that has developed the concept of "hierarchical propositions" (FSS). Second, a method known as "Bayesian networks"—or "Bayes' nets" for short—that has been the focus of a previous study in this journal.. Case studies based on real events are included in the debate. When a jury considers all of the evidence, it's evident that, although the inferences about the source of a crime sample's DNA may be plain as day, the conclusions about the identity of the actual culprit may be considerably more tenuous.

Conclusions

Anyone who has dealt with the presenting of scientific data in court is well aware of how difficult it can be for jurors, especially in complicated cases, to sort through all the possible outcomes. We do not promise to have a quick fix for this kind of complication. However, we are certain that our paper's primary themes may be used as a tool for analyzing the complex challenges that arise in situations when just a little amount of DNA is brought to the court's

attention. According to forensic practitioners' comments, it is evident that the scientist is better suited to examine the significance of the data in a case context that necessitates taking into account elements like DNA transmission and persistence. According to a wide range of critics, it is critical to evaluate forensic biology evidence in light of activity-level claims. As a result, this will aid in the court's decision-making process and minimize any misinterpretations of the meaning of evidence's value. Court assessments provided activity level propositions, prevent the improper carrying over of findings given source level propositions to conclusions about activity level propositions, where the latter demands specialized knowledge that the judiciary can't be expected to have. However, it may be difficult to maintain track of this principle since a competent defense analysis of DNA evidence may not be readily accessible. DNA matches are typically seen by ordinary people as irrefutable proof, so even well-intentioned defense attorneys may find it better to manoeuvre around the evidence than spend the resources required to contest it.

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