Can Investigators Objectively Navigate Bloodstain Pattern Evidence When Presented with Potentially Biasing Information?

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Introduction

The landscape of forensic investigations has changed drastically over the past twenty years and so has the way investigators respond, document, collect and analyze evidence related to a criminal act (de Gruijter, de Poot, Elffers, 2015). New techniques, technological breakthroughs and sophisticated machines assist investigators and laboratory technicians navigate the vast terrain of evidential possibilities. In 2009, the National Academy of Sciences (NAS) published *Strengthening Forensic Science in the United States: A Path Forward,* which detailed many shortcomings in all the forensic arenas. The report specifically addressed the cognitive contamination of evidence by stating, "…Unfortunately, at least to date, there is no good evidence to indicate that the forensic science community has made a sufficient effort to address the bias issue" (p. 8-9). Contextual information received by investigators and laboratory workers before, during and even after the close of an investigation can have serious implications on the resulting analyses, reports, testimony, information filing decisions and adjudication process in general, leaving juries and judges at the mercy of potentially misleading information upon which to base their decisions (Levett & Kovera, 2007).

The National Commission on Forensic Science has actively been working on formulating institutional and organizational best practices relating to cognitive and contextual bias in forensic assessments through its Human Factors Subcommittee. This subcommittee has been hard at work since 2014. Its efforts have not concluded; however, evidence of progress made has been documented in the National Commission's meetings in Washington D.C (NIST, 2015). Of particular interest, the subcommittee has identified a key issue in that there is not a great deal of agreement in the field about what facts in an investigation can (and should) be considered irrelevant, and therefore, liable to create bias in a forensic scientist's assessment. This article explores the issue of bias and what is at stake, uses blood pattern analysis as an example, and suggests potential solutions and contrasts them with the solutions the Human Factors Subcommittee is toiling over in its recent meetings.

Understanding Bias

Biases are an inherent part of our lives and take place in our day-to-day routine activities. Bias is not always bad. It can assist with quick decision-making processes, when speed overrides the need for precision (Stibel, Dror & Ben-Zeev, 2008). In forensic practice, speed never supersedes the need for precise measurement, documentation and collection techniques, making bias a negative attribute to forensic investigations (Dror & Cole, 2010). There are different types of bias that can affect forensic disciplines: 1) Confirmation bias: reaffirming preconceptions to the exclusion of evidence to the contrary; 2) Anchoring bias: the first piece of information received tends to drive the rest of the investigation or conversation; 3) Overconfidence bias: Experts seem to be most susceptible to this type of bias (Dror & Rosenthal, 2008; Dror, Charlton & Peron, 2006), in which cognitive 'shortcuts' based upon previous experience take the place of meticulousness, leading to confirmation bias and the self-reaffirmation that they are indeed correct; and 4) Cognitive or 'blind spot' bias: the tendency of people not to recognize their own biases, allowing this latent denial to drive their choices (Leadbetter, 2007, Kassin, Dror & Kukucka, 2013). Many of these types of biases have been discussed at length within the Human Factors Subcommittee's presentations and reports at the routine meetings of the National Commission (see http://nist.gov/forensics/ncfs.cfm).

Many new technologies assist in forming a statistical match or similarity between forensic evidence and a known exemplar or template, such as fingerprints or DNA. Even with the advent of new applied sciences, human cognition still plays a large role in the interpretation of statistical data, therefore making these judgments prone to the aforementioned biases. Previous studies have shown that fingerprint and DNA analysis, termed the 'gold standards' in forensics, can be flawed and prone to cognitive and confirmation bias by expert examiners (Dror, Champod, Langenburg, *et. al*., 2011; Dror, 2011; Dror & Cole, 2010, Dror & Hampikian, 2011, Thompson, Tangen & McCarthy, 2014). Other areas of forensic science such as handwriting analysis (Kukuka & Kassin, 2014), auditory analysis (Lange, Thomas, Dana & Dawes, 2010) and anthropology (Nakhaeizadeh, Dror, Morgan, 2013) have also been shown to break down in the wake of cognitive preconceptions, described below.

Although these areas have known standards of comparison (suspect/victim's fingerprints, DNA, handwriting, vocal submissions, and Forensic Anthropology Data Bank of known reference material/targets), they can still be potentially prone to negative cognitive influences along with practices without a known standard, such as bloodstain pattern analysis (BPA). "For example, having a target to compare to may cause motivated perception that affects what an expert examiner may see in the actual evidence" (Dror, 2008). Research into the area of bias in BPA has been extraordinarily limited, with only a single published empirical study (Laber, Kish, *et. al.* 2014) to date designed to test the robustness of bloodstain pattern expert decision-making when faced with biasing information.

Bloodstain pattern analysis is a unique blend of science and art in that investigators are tasked with using known pattern 'types' to assist with a top-down as well as bottom-up analysis of a violent crime scene. Blood is shed and left behind in specific shapes, distributions and amounts that help lead to possible conclusions of mechanical causation. Because of the chaotic nature of violent crime scenes, rapid movement of those involved (both victim(s) and suspect(s)) and the unsystematic way that blood is left behind, definitive conclusions regarding causation are often difficult or even impossible. Additionally, investigators face a number of challenges outside the realm of analysis including time pressures, deference to a senior analyst, too much extraneous 'noise', emotional exhaustion and physical challenges inherent in forensic field work (Pyrek, 2010). Add to this list several forms of potential bias and the task of objectively completing any type of analysis seems next to impossible. Of course, experienced analysts have many hours of specific training course work, formal educational classes and hundreds if not thousands of field cases upon which to draw their information and conclusions (Laber, Kish, et.al, 2014). Unfortunately, there are an infinite number of possibilities with regard to bloodstain patterns at a crime scene and a limited number of codified possibilities to work with in the area of analysis, as stated by James, Kish & Sutton, "Acknowledging that every scene is unique and may require a good deal of innovative thinking or actions, the basics of the scientific method must still be followed" (2005). Previous scholars have attempted to create flow charts (James, Kish & Sutton, 2005), parse available definitions and terminology into an adaptable vernacular (SWGSTAIN, IABPA, 2014) and swing the pendulum between classification and mechanistic cause to the point where it seems no laboratory or department uses the same definitions.

Problems not only arise from misinterpretation by experts, investigators and laboratory analysts. Juries will ultimately receive this information and rely upon it to potentially deliberate about a defendant's guilt or innocence. This is important because real-world implications could imprison innocent people based only upon subjective, biased analysis of pattern evidence (Dror, Charlton & Peron, 2006) or alternatively may allow those guilty of crimes to go free. Because there are different possibilities of causation in a single pattern type and contrasting viewpoints by bloodstain pattern experts, juries are left extrapolating information and possibly; a) seeing evidence that is not there, b) choosing which expert they 'like' more, c) discounting all testimony as unscientific and therefore coming to a conclusion with no bloodstain analysis at all, or d) being unable to weed through the mire of subjective conclusions and wind up a hung jury, resulting in a mistrial. In the David Camm murder case (Schneider, 2013), two bloodstain pattern experts came to opposite conclusions about the same pattern on the defendant's (a former State Trooper accused of killing his family) t-shirt. One expert stated that the stains were the result of a gunshot while the other stated it resulted from transfer from one of the victims when he discovered they were deceased. The case went to trial three times and Camm was initially found guilty. He was subsequently acquitted after an appeal. Cognitive influences in bloodstain pattern analysis are not simply an awareness issue. There are substantial implications when cognitive and confirmation biases are introduced into the investigatory process.

Bias in Bloodstain Pattern Evidence

Bloodstain pattern analysis has been utilized in the criminal justice process for nearly a century, perhaps most infamously in 1966, when Dr. Paul Kirk testified to bloodstain pattern evidence during the trial of Dr. Sam Sheppard who was accused of murdering his pregnant wife, Marilyn (Holmes, 2015). Sheppard was subsequently acquitted based solely upon the findings by Dr. Kirk after being found guilty 13 years prior. The area of bloodstain pattern analysis itself has undergone extensive scientific testing by practitioners (James, et.al, 2005) academicians and fluid dynamics engineers (Kabaliuk, et.al., 2010), however none have been able to fully codify the processes by which blood behaves under the innumerable circumstances of a violent act.

One empirical study of cognitive and confirmation bias in the practice of bloodstain pattern analysis was published in 2014 by Laber, Kish, Taylor, Owens, Osborne & Curran. Funded by the National Institute of Justice (NIJ) in the wake of the 2009 NAS report, part of this study examined how experts are affected by bias and revealed that it plays a large part in the interpretation of bloodstains on various substrates. Participants included selected experts (N=27 (Phase I) and N=30 (Phase II) with extensive training hours and testimony experience in the area of bloodstain pattern analysis. All were members of academic forensic associations and reported comprehensive knowledge. In addition to correct/incorrect answers to given pattern types, this study also factored in the variable of contextual bias, which was significant relative to the substrate. "There was a significant overall difference in the number of correct, incorrect and inconclusive responses as a function of context ($p=0.003$)" (p.10).

Experts routinely testify to findings both from the primary crime scene as well as from analysis of case files if hired as a consultant. Additionally, studies have found that experts may be the worst offenders when it comes to confirmation and anchoring bias due to their propensity for self-fulfilling predictions (Dror & Rosenthal, 2008; Dror, Charlton & Peron, 2006). One issue with the Laber, et. al. (2014) study is that the authors handpicked the experts who were sent the materials. Personally choosing participants for a bias study could alter the results by virtue of the authors' knowledge of participants' backgrounds and introduce possible selectivity bias.

Proposed Solutions

Logically following these assertions and empirical evidence, it is imperative that forensic analysis becomes as immune to bias as humanly possible. Suggestions have ranged from a "Linear Sequential Unmasking" of information (Dror, 2015), which proposes to limit the information given to examiners initially and only allow it to be revealed as a function of necessity rather than compulsion, to refinement of the peer-review process in general. In the article *Practical Solutions to Cognitive and Human Factor Challenges in Forensic Science,* Dror continues to explain how cognitive bias influences the top-down and bottom-up process of evidentiary analysis and becomes more tenuous as the case grows more complicated:

<i>*"The danger of bias is dependent on the complexity of the case (as the decision is more difficult, nearer to the threshold, bias is more likely to effect the decision outcome), and the level and type of contextual bias is also very important (some cases have minimal biasing context, and other cases are full of potential biasing contextual information). Hence, more susceptible to bias are difficult decisions made within biasing contextual information, the 'danger zone'" </i>*(2013, p.6).

Refinements of the information process are certainly needed to help attenuate bias in all areas of forensic science. This debate continues as new solutions are suggested and presented at professional conferences, academic lectures and formal colloquiums. The Human Factors Subcommittee has offered the following recommendations to date 1) develop a training product on human factors and cognitive bias, 2) publish a statement of principles on contextual bias, including recommendations on what contextual information should be eliminated from a forensic assessment to minimize any potential for bias, and 3) develop a standard and definition of "task relevant" features for forensic analyses, noting that

> *"…forensic scientists who perform pattern matching tasks (e.g., comparison of fingerprints, toolmarks, shoeprints) should base conclusions on the characteristics of the items examined and should not be influenced by information about whether a particular suspect confessed, or had a convincing alibi, or was incriminated by other forensic evidence. It is appropriate for forensic scientists to consider and rely upon any information that helps them assess the strength of the inferential connection between the evidence they have examined and the conclusions they are asked to reach. It is not appropriate for them to base conclusions on*

information that supports a particular conclusion (e.g., that the suspect confessed) if that information has no bearing on the strength of the inferential connection between the evidence they have examined and the conclusions they are asked to reach. The scientific integrity of forensic scientists' conclusions is undermined if they allow their putatively scientific judgments to be influenced by information from outside their domain of expertise" (National Commission on Forensic Science, 2015: 1-2).

At this time, the Human Factors Subcommittee is finalizing public comments of their draft work product (see: http://www.justice.gov/ncfs/draft-work-products-open-public-comment) and will have a final draft available soon.

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