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pat.laturnus@rogers.com

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dschuessle@msn.com

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jamesforen@aol.com
President’s Message

Hello Everyone,

2015 continues to be a good year, with many of things going on and opportunities to get involved. High on the list is the 2015 IAPBA Fort Worth Training Conference. The schedule is set and we're looking forward to an excellent event. Other opportunities seem more difficult to realize. As we pick on the scrawny budget carcass it's hard to get the few training dollars that "might" be available. However, the need is there and we must work to ensure that those in control of the scrawny carcass are aware of the importance of training.

We all encourage new people to get involved, to have a look at what we do and understand the value of Bloodstain Pattern Analysis. It's a bit disheartening when we have an ideal person but get stalled when it comes to training. The budget people may want you to find ways to cut corners, since the basic 40 hour course should teach them all they need to know. That's when we need to step-up. Law enforcement leaders tell the public that only qualified people attend crime scenes and physical evidence is properly processed. We need to ensure that those leaders put their money where their mouth is. In the case of bloodstain pattern analysis that means to get quality evidence we need to do more than just take photos at a scene. Of course the challenge begins at the scene, but then it's the analysis, the recording of data and writing a report. All of this culminates in providing quality evidence to the court. That's what our Sheriff's, Chiefs of Police and Lab Managers are telling the public, so why wouldn't they make the necessary investment.

Advanced courses are available and it's interesting to hear that they are sometimes difficult to fill. Our challenge is to ensure that we are aware of the latest techniques and apply current technologies. It's not good enough to say that "we've always done it that way". Repeating a weak set of guidelines or even worse repeating a mistake is no way to ensure that quality evidence gets to court.

Bloodstain Pattern Analysis is recognized for the value it brings to understanding and describing a bloodletting scene to the investigator and to the court. We are all encouraged by the good work that's happening in the field. Here's hoping that we all work together and continue to grow.

I'm looking forward to the Fort Worth Conference and the opportunity to learn and improve. I hope that you are planning to attend and look forward to seeing you there.

Pat Laturnus
President
IABPA
A Commentary on Synthetic Blood Substitute Research and Development

Theresa Stotesbury (M.Sc.), Mike Illes (M.Sc.), Paul Wilson (Ph.D.) and Andrew Vreugdenhil (Ph.D.)

Purpose

This commentary is designed to serve as a brief introduction into the importance of developing a synthetic blood substitute for use in crime scene reconstruction, training and research. It is intended to supplement the information and discussion presented at recent IABPA conferences over the past few years.

What are synthetic blood substitutes?

A blood substitute is any substance that is used to mimic a desired function of biological blood. In a forensic context, a blood substitute can be considered an alternative fluid to whole human blood. For example, animal blood from ovine, porcine, bovine, and equine sources are considered blood substitutes to whole human blood. These sources are quite often used in BPA reconstruction, training and research, and their use is well justified. This is because the physical properties of these animal blood sources have been measured and/or adjusted to mimic desired human blood values accordingly [1-4].

A synthetic blood substitute (SBS) is our defined version of an alternative to both whole human and animal blood. An entirely separate class of SBS have been created for medical purposes, and are based on hemoglobin function to aid in oxygen transport within the human body [5, 6]. In fact, research and development on medical blood substitutes has been around for hundreds of years, dating back to Christopher Wren’s work in the late 1600s [7]. However, a very different requirement exists in the BPA community where there is a need to create materials with a precise fluid dynamics equivalent to whole blood. Today, only a few such commercial SBS exist in the forensic market and include, but are not limited to, Spatter Blood, Synthetic Blood and Forensic Chemistry of Blood Types Kit [8-10]. These products can be purchased through many forensic distributors worldwide. There is little published literature on the validation of these commercially available synthetics. Thus the need for blood substitute design is still very much in demand in this context and is critical in addressing the concerns of the National Academy of Sciences (NAS) regarding standardization [11].

Research articles and graduate level theses do exist on SBS research and design [12-14]. However this research is still in its infancy, with progress suggesting the requirements and testing procedures for candidate SBS materials. There is real potential to expand research and development in this area by incorporating more ways to design and test the physical, chemical and biological requirements a candidate SBS must meet.

Why develop them?

With our increasing knowledge of biohazard health and safety concerns surround blood, it is important to consider incorporating the use of SBS in reconstruction, training and research models. Careful designs of an SBS can offer the following features:

- Contains only non-hazardous components to meet the requirements of basic health and safety codes
- Uses components with long term stability to avoid the effects of clotting, hemolysis and/or acidosis for use at ambient temperatures
- By-passes need for ethics approval which can sometimes take a long time to obtain
- Creates cost-effective alternatives to whole blood by mitigating shipping and cleanup costs

Trent University, Peterborough, Ontario, Canada, 1600 West Bank Drive, K9J 7B8
For those in the BPA discipline who are skeptical of SBS development it is important to understand that we live in a world of synthetics. Examples would include the Splenda we put into our coffee before work to the pleather couches we relax on after work. Perhaps we can even think of some of our current practices as bordering on the realm of blood substitute development. For example, the addition of an anticoagulant to whole blood sources technically creates a whole new material as these chemicals are not naturally present in the body. Many of us can speak to differences between bloodstain patterns created with fresh blood with and without anticoagulants made by the same mechanism. Understanding the effects of anticoagulants on resulting bloodstain patterns is an interesting and important topic for future bloodstain research and fluid validation [15]. As scientists we are constantly questioning and challenging the way we think about the world we observe around us. In the SBS world, the best question to ask is, “What scientific characteristics does this product share with whole human blood? And in what situations is it an acceptable blood substitute?”

Defining SBS requirements

Like most areas in forensic science, SBS research and development requires an interdisciplinary approach. BPA consists of integrated concepts from biology, chemistry, physics, mathematics, engineering, as well as materials science. In the eyes of a practical materials scientist SBS development involves utilizing the simplest chemicals that have the same desired material properties of blood in the most efficient and cost-effective way possible. For example, knowing that blood is more than 50% water helps a materials scientist focus on an approach that utilizes water-borne chemistries, which greatly reduces the market cost of a final product. What must now follow this thought process is the scientific research that will demonstrate that water-based formulations have utility as practical and convenient materials for an effective SBS.

With regards to BPA, SBS should include physical, chemical and biological considerations into their design. The most obvious being physical properties as the physical mechanisms drive the differences in stain and pattern appearance. Fluid dynamic considerations must be accounted for at the initial stages of development [16]. Many of the reported bloodstain pattern mechanisms provide explanations that incorporate blood’s viscosity, surface tension and density. These are three physical properties that significantly contribute to pattern appearance. It is important that SBS meet the expected whole human blood range of these physical parameters. If they do not, data should be provided as to how these property differences affect their resultant patterns.

Beyond the physiological properties, the ability to chemically and biologically modify the fluid is advantageous for increasing the applicability of the fluid to all components of BPA. Two useful examples include the ability of an SBS to:

(i) generate a practical genetic profile
(ii) react to commonly used chemical enhancers.

Again, this speaks to fluid standardization, and can be considered quite useful for practices like proficiency testing and method validation.

Understanding the fluid-target surface interactions is critical in SBS research. Crime scenes are complex, and as we know, blood does not tend to be found on only one type of surface. In fact, many surfaces are complex compositions of natural and/or synthetic material. Textiles are an excellent example of a complex target surface. Blood wets much differently on a wide array of textile surfaces [17]. Understanding this wetting process, possibly as a function of fluid absorption or adsorption will help define what chemical properties a synthetic should have to successfully mimic expected bloodstain patterns found on select textiles. Some work with synthetics are currently trying to address these concerns [18].

These are but a few of the relevant properties of blood a synthetic should consider. Considerations of drying times, aging properties, spectral imaging capabilities, etc. can also be included in SBS design if it is considered relevant to the task at hand. It is easy to appreciate now that a one-kind-fits
all approach may not necessarily be the only solution to blood substitute development. Perhaps a solution will be a ‘create-your-own’ SBS kit to suit desired research and/or reconstruction needs.

**An example of a candidate material**

We present here one example of a synthetic approach. This by no means precludes other possible routes but is presented as a chemistry that provides a viable solution. Sol-gel chemistry uses a process that we believe can fit quite well into SBS research and development. It is a water-borne chemistry that uses the self-assembly of silane-based precursors to create liquid materials that are used to create thin-films on a variety of surface types. The components in sol-gel systems have minimal toxicity and, in our case, have demonstrated long-term stability and shear thinning properties. These sol-gel materials are currently being investigated under impact simulation conditions [19]. The colloids and/or particles that can be built using the sol-gel process can be tailored to have a chemically inert core, with a functional surface layer. This functionality can be designed to be tolerant of additional features, for example, the covalent binding of DNA as well as encapsulation of iron-based organics for simulation of chemical enhancement techniques.

**Performance testing and assessment**

It is not enough to say qualitatively that a synthetic can make a stain that appears like blood. The properties of the SBS must also quantitatively fit within a clearly defined and accepted range. This means that the synthetic should be assessed and placed within a spectrum of all types of fluid performance. For example, performance of an SBS should be directly compared to whole blood values, as well as fluids that are much different than blood (like the classic Newtonian, water). This requires a solid understanding of blood dynamics and how bloodstains form in relation to other fluids. There is a two-fold advantage to this type of approach. We can learn much more about bloodstain mechanisms themselves, and in doing this we provide a robust means to scientifically validate the performance of a blood substitute, whether it is from an animal source or completely synthetic. Regardless, the main point of this is to suggest that in order to validate the performance of a SBS, a transparent qualitative and quantitative testing procedure must be implemented to provide a direct relation to blood and other fluids.

**Where to go from here?**

There is an obvious and exciting need to continue exploring the concept of SBS design and development. A synergy exists between creating a deeper understanding of bloodstain mechanisms involved in crime scene dynamics and designing candidate materials that do the same thing. Communication between researchers and practitioners is key for successful and useful product development. A strong relationship between academia and forensic agencies will translate into product development that can benefit all areas of BPA.

**References**

Contextual Bias: What Bloodstain Pattern Analysts Need to Know

Rachel Zajac¹, Niki Osborne¹,², LeeAnn Singley³ and Michael Taylor²

Abstract

Bloodstain Pattern Analysis (BPA) is a highly involved process. In addition to the complexities and ambiguities of the patterns themselves, examiners are often presented with considerable information about other aspects of the investigation. There is growing concern that this information could unduly influence both pattern classification and scene reconstruction, in a process known as contextual bias. In this article, we introduce the notion of contextual bias, and look at its potential impact on forensic scientists’ decisions and, more specifically, the potential for bias in BPA. Based on the picture so far, we suggest ways to mitigate bias in BPA, and discuss future directions for research in this field. To conclude, we discuss the implications of contextual bias as an expert witness in the courtroom.

A Brief Introduction to Contextual Bias

Our brains are finely tuned high performance machines. Without our awareness, they perform numerous incredible feats that help us to perceive, interpret, and negotiate the world around us. Many of these feats use our existing knowledge and experience to guide us. For example, the reason that CAPTCHAs (see Figure 1) are used on websites is to confirm that we are human; computers cannot interpret letters and words that are distorted in this way. Likewise, if we are handed a page of text on which a word or two is smudged, we can generally decipher the smudged words by interpreting them in the context of the non-smudged material. You can even read the text in Figure 2, despite the fact that most of the ‘words’ aren’t even words.

![Figure 1. Examples of CAPTCHAs, used as a means of distinguishing a human from a computer.](image1)

![Figure 2. Passages like this are relatively easy to ‘read’.](image2)

But the very same processes that our brains use in these situations sometimes let us down. Have you ever waved to a friend driving past you in their car, only to find out that it was a stranger driving a similar car? Or discovered that you’ve been singing the wrong lyrics to a particular song all your life, because they made more sense to you? Or tried to proofread your own work and failed miserably? In each of these cases, you have used contextual information to guide your behavior, and it has backfired. You probably thought that you were making an objective decision based on the data at hand, but in actual fact your decision has been informed by extraneous factors.

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¹ Department of Psychology, University of Otago, New Zealand (address correspondence to rachelz@psy.otago.ac.nz)
² Institute of Environmental Science and Research Ltd (ESR), Christchurch Science Centre, New Zealand
³ Grayson Singley Associates, LLC, Duncannon, Pennsylvania, USA
When talking about these kinds of issues, psychological scientists refer to two interactive processes called bottom-up processing and top-down processing. When we use bottom-up processing, our perception of a stimulus rests solely on the stimulus itself—in other words, our decisions are driven purely by the data. In contrast, when we use top-down processing, our decision is shaped by information that we bring to the situation—information outside of the data.

To some extent, we use a combination of bottom-up and top-down processing in every decision that we make. When we’re shown a picture of an elephant and asked what it is, for example, we feel like our decision is solely based on the information in the picture. What actually happens, however, is that we make a decision using what’s in the picture (bottom-up cues) in conjunction with our knowledge of what elephants usually look like (top-down cues).

But many of the decisions that we face in our lives are substantially more difficult than identifying elephants from pictures. When situations are ambiguous, complex, or time pressured, the top-down cues that we use become more extensive. They might include our motivations, our emotions, our knowledge, our expectations, and our prejudices. Your brain uses any top-down cues it can to help it out, allowing you to make quick and definitive decisions—and to act on them. A reliance on top-down processing in these cases might result in us “filling in the gaps” so that we see something that isn’t there. Or not seeing something because we don’t expect it to be there. Or seeking, interpreting, or remembering information in a way that confirms our hypotheses. These kinds of effects are often referred to as contextual bias and, to make matters worse, they occur without our conscious awareness.

Of course, waving at strangers or singing the wrong lyrics doesn’t tend to result in any harm to anyone. But contextual bias can occur in any situation in which a human is required to make a judgment based on incomplete or complex information. Think about the doctor picking up a scalpel, the air traffic controller directing an aircraft, or the fighter pilot firing a missile. In each of these cases, contextual bias has the potential to be disastrous.

**Contextual Bias in Forensic Science**

Could these same processes predispose forensic scientists to error? The answer is a resounding yes. Forensic science involves an amalgamation of three factors that interact to increase vulnerability to context effects. First, forensic evidence is often ambiguous, incomplete, degraded, distorted, or a combination of these. Second, forensic scientists operate within an environment that is rich in contextual cues—including knowledge about a case, expectations about the evidence, and motivation or pressure to reach a conclusion. Finally, many forensic decision-making processes lack objective standards and methodologies, leaving decisions open to a considerable degree of subjectivity.

Indeed, recent decades have seen numerous indications that forensic scientists are vulnerable to contextual bias. Some of these indications have come from high profile misidentifications in which contextual influences appeared to be at play. We are all familiar with cases like that of Brandon Mayfield, who was wrongly implicated in the Madrid bombings after several experts matched his fingerprint to one found at the scene. Or that of Kennedy Brewer, who spent 7 years on death row after a forensic odontologist matched his dentition to an alleged bite mark on a murder victim—a mark that turned out not to be a bite mark at all. Case studies like these, however, are anecdotes—not data. Although they tell us that contextual information might influence decisions, they tell us almost nothing about the conditions under which this occurs, or the mechanisms behind this effect. Obtaining that information requires empirical research.

Empirical research into bias in forensic decision-making emerged in the 1980s, when Larry Miller published several papers showing the potential for contextual bias in the examination of hair (Miller, 1987) and questioned documents (Miller, 1984). Unfortunately, as often occurs when researchers point out potential problems in a field, Miller was roundly criticized by practitioners and had difficulty finding forensic journal editors who would publish his research. His work in this area ceased soon after.

Research in this area didn’t surface again until the mid-2000s, when Itiel Dror began to publish similar findings around the interpretation of fingerprint evidence (Dror & Charlton, 2006; Dror,
This research showed that people’s decisions about fingerprints could be influenced by accompanying contextual information. For example, Dror and his colleagues observed that people were more likely to judge fingerprint pairs to be a match if the prints were preceded by graphic crime scene images (Dror et al., 2005). This finding has since been replicated, with researchers incrementally narrowing down the effect to the crime-related nature of the information, rather than the presence of additional information per se or even the presence of highly emotional information (Osborne & Zajac, under review; Zajac, Barrett, Hegemann, & Osborne, 2015).

Of course, the major criticism of studies like those mentioned above is that their participants are laypeople, not experts. And in fact, experts have made numerous statements saying that the research doesn’t apply to them. Take Martin Leadbetter, for example, who in 2007 was the chairman of the Fingerprint Society. Leadbetter made the following statement in response to some of Dror’s research:

“...any fingerprint examiner who comes to a decision on identification and is swayed either way in that decision-making process under the influence of stories and gory images is either totally incapable of performing the noble tasks expected of him/her or is so immature that he/she should seek employment at Disneyland.” (Leadbetter, 2007; p. 137)

Statements like this reflect the view that forensic analysts have special qualities that others don’t. And while this might be true in terms of analysts’ training and experience, the research on expertise tells us that the distinction is not that simple. In fact, when we look at the factors that characterize expertise, we start to see that some of these factors—the ability to filter out information seen as irrelevant, to simplify information, to utilize past experience, or to do things more quickly—leave experts highly susceptible to contextual influence.

In fact, Dror argues that experts could be more vulnerable to contextual bias than novices, because with expertise comes an increase in automaticity, decisions that are less easily articulated, more defined expectations, less reliance on data and more reliance on other factors, and more snap judgments. Each of these factors increases vulnerability to bias and this vulnerability is compounded by the fact that experts tend to be highly confident in their abilities, and often believe that they are immune to bias (Dror, 2011, 2013a).

Indeed, data show that experts, like lay people, are at risk of making decisions that are unduly influenced by context. For example, when re-presented with a pair of fingerprints they had deemed to match years earlier, but told that the prints were those from the high profile misidentification of Brandon Mayfield, 80% of the fingerprint examiners in Dror et al.’s (2006) study changed their original conclusion. In 2009, the National Research Council (NRC) put out a call for more research to address cognitive vulnerabilities in forensic science. Such investigations have occurred into forensic odontology (Osborne, Woods, Kieser, & Zajac, 2014; Page, Taylor, & Blenkin, 2012), handwriting examination (Found & Ganas, 2013), forensic anthropology (Nakhaeizadeh, Dror, & Morgan, 2014), bullet comparison (Kerstholt et al., 2010), DNA interpretation (Dror & Hampikian, 2011), and now bloodstain pattern analysis (BPA; Laber et al., 2014). The overarching finding from these studies—that contextual information can influence interpretations—comes as no surprise to psychological scientists, who have examined these basic processes for more than a century.

It is important to note that contextual bias is not unique to forensic science. Many fields in which humans play a large role in the decision-making process—medicine, for example (Croskerry, 2003; Graber, Gordon, & Franklin, 2002)—are grappling with similar issues.

What about BPA?

Like many forensic disciplines, BPA shows all three of the characteristics that converge to form ‘perfect’ conditions for contextual bias: ambiguity, a rich contextual environment, and subjective methodology. Below, we examine these factors as they relate specifically to BPA.
1. Ambiguity

Ambiguity is frequently a feature of bloodstain pattern evidence. Different bloodletting mechanisms can give rise to bloodstain patterns with similar or indistinguishable characteristics. In cases where only a small number of stains are present in the pattern, analysts have to decide whether or not there are sufficient data in the pattern to inform a reliable classification. Analysts also need to consider characteristics of the surface on which a bloodstain appears. Surface texture and absorbency, for example, can alter the appearance of bloodstains. The need to consider these factors means that BPA is rarely a clear-cut interpretation process.

The potential for ambiguity in bloodstain evidence was highlighted in the case of Camm v State (2011). David Camm, a former US state trooper, went to trial three times for the murder of his family, based partly on bloodstains present on his T-shirt. Bloodstain pattern experts employed by the prosecution and the defence could not agree on the bloodstain pattern classification. The prosecution argued that the bloodstains were the result of gunshot spatter, with the inference that Camm was in close proximity to the victims when they were shot. The defence, on the other hand, argued that the stains were the result of a simple transfer of blood when Camm came home to discover his deceased family members. Camm was initially found guilty, but was acquitted after a second trial and an appeal.

2. Rich contextual environment

Context is, for the most part, an unavoidable component of BPA. Unlike friction ridge impression examiners, who can (and should) make their decisions based only on the impressions in front of them, bloodstain pattern analysts often observe and consider the bloodstain pattern alongside various forms of contextual information. Analysts may also be required to use this contextual information to support their statements when giving expert evidence in court (e.g., “my interpretation of this bloodstain pattern is consistent with the pathologist’s finding that there was a breached artery”).

Even in situations where context is not relevant to a decision, it is usually impossible to isolate bloodstain patterns from other information within a scene. Even at the most basic level of analysis, bloodstain pattern analysts need to view the entire crime scene to determine if—and where—blood has been deposited. In doing so, however, the analyst might encounter weapons, deceased persons, or other forensic information that is often unnecessary for pattern classification. This extraneous information, alongside details provided directly by police investigators or other forensic analysts, could play a role in the way that an analyst approaches the scene and interprets the information within it (Laber et al., 2014).

Additional contextual cues come from the environment in which bloodstain pattern analysts work. Many analysts are employed by law enforcement agencies, or for organizations that exclusively carry out law enforcement work. There is usually considerable communication between investigators and analysts. More often than not, there are pressures of limited time, money, and resources. Many bloodstain pattern analysts describe subtle—or not so subtle—pressure from the police investigators or prosecutors engaging their services, who might have outcome motivations that go beyond the goals of a scientific analysis.

In some situations, for example, the same analyst is responsible for interpreting more than just the bloodstain pattern evidence from a given scene. The analyst may be tasked with the recovery of latent print or footwear evidence, as well as evaluating the bloodstain pattern evidence. The implicit expectation that these forms of evidence will converge could play a significant—yet unconscious—role in decision-making.

Effects like these might be amplified when the bloodstain pattern analyst is also the homicide investigator. An in-depth knowledge of the investigation could compromise the ability of these investigators to provide an unbiased bloodstain examination, particularly when the bloodstains are examined for the purpose of “supporting” or “refuting” involved party statements.
3. Subjective methodology

Objective methodologies and standards for many forms of forensic science are lacking, and BPA is no exception. Although standardised methodologies for BPA have been suggested (Gardner, 2006; Saviano, 2005), the use of these protocols has not become established, and individual forensic agencies often employ their own methods. As a result, BPA continues to rely on the training, experience, and—ultimately—the subjective judgement of the analyst. Unfortunately, bias can occur in any situation where subjective judgments are applied (Thompson & Cole, 2007). In their report, the NRC (2009) considered this problem significant, pronouncing that “in general, the opinions of bloodstain pattern analysts are more subjective than scientific” (p. 178) and that “the uncertainties associated with bloodstain pattern analysis are enormous” (p. 179).

Complicating matters further is the fact that the bloodstain pattern analyst’s task can involve numerous components—from the basic classification of patterns to a detailed reconstruction of the events that led to the bloodshed. Clearly, the relevance of contextual information differs markedly across the varied components of the task. At this time, there are no rigorous protocols that direct analysts through these tasks. Bloodstain terminology—which can differ across laboratories—can also accentuate the imprecise boundary between classification and reconstruction by being weighted toward pattern formation mechanisms rather than a summary of pattern characteristics (Arthur, Cockerton, de Bruin, & Taylor, under review).

Empirical Research into BPA

In the first study of its kind, Taylor, Laber, and Kish, completed a research project sponsored by the National Institute of Justice in which they aimed to provide a baseline measure of reliability in BPA (Laber et al., 2014). Over thirty experienced bloodstain pattern analysts examined bloodstain patterns created on either rigid non-absorbent surfaces, or fabric surfaces. The patterns varied in the extent of staining, the type of pattern, the substrate they were created on and, critically, the contextual information that accompanied them. The contextual information contained cues as to the pattern’s mechanistic cause. These cues either suggested the correct mechanistic cause (positively biasing), suggested an incorrect mechanistic cause (negatively biasing), or were neutral.

Overall, analysts made errors in a significant proportion of classifications on both surface types. The proportion of misclassifications increased when the contextual information was negatively biasing, and decreased when the contextual information was positively biasing. Although more research is needed to identify the specific methodologies that analysts employed in order to classify the patterns, these findings provide a preliminary indication that bloodstain pattern classification decisions are vulnerable to contextual influences.

What can we do?

To this point, we have suggested that 1) certain factors make BPA vulnerable to contextual bias, and 2) that classification decisions are indeed influenced by contextual information. In light of these issues, what steps can the discipline take to minimize the risk of contextual bias in practice?

Awareness

Raising awareness of an issue is usually seen as an important first step toward resolving it. Trying to solve the problem of contextual bias purely by raising awareness, however, is problematic for two main reasons.

First, it can be difficult to get analysts to acknowledge that bias could affect their work. Some do not think that forensic science is vulnerable. Some think other forensic disciplines are vulnerable, but not BPA. Some think that their bloodstain pattern analyst colleagues are vulnerable, but feel personally immune. Reactions like these are not surprising to psychological scientists, who have established that humans have a bias blind spot (Pronin, Gilovich, & Ross, 2004). That is, even if we
acknowledge that a bias exists, we tend to think it applies only to other people. We might dismiss biased individuals as ‘a few bad apples’ or we might believe that we are immune to influences that bias others’ judgments.

To combat this problem, those who run BPA training courses might consider dedicating a portion of their curriculum to demonstrating that forensic scientists are not immune to bias. When preparing mock crime scenes, instructors could create scenarios where contextual influences might come into play. Bloodstained fabric that is subsequently folded, for example, might create transfer stains that have the potential to be erroneously “matched” to a weapon placed at the scene. These kinds of scenarios can serve as first hand examples of contextual bias and its effects.

Second, even when analysts acknowledge that they are vulnerable to bias, expecting them to correct for that bias based only on an awareness that it occurs requires them to employ cognitive resources that they simply do not have. Correcting for a bias requires us to know two things: 1) the direction of the bias; and 2) the magnitude of its effect. Because both of these things are essentially unknowable, people who attempt to correct for one bias typically end up introducing a second (Nisbett & Wilson, 1977; Wilson & Brekke, 1994).

Training and objective methodologies

Although BPA training is well established, there is a growing realisation that this training should include a new focus on the fundamentals of the fluid dynamics of bloodstain pattern formation (Adam, 2012; Attinger, Moore, Donaldson, Jafari, & Stone, 2013). The understanding and application of these principles as they apply to BPA will go a long way to establishing objective criteria for the classification of bloodstain patterns, as well as helping to ensure that conclusions presented in court have a solid basis in science. These efforts to decrease subjectivity in BPA are also likely to reduce bias.

In other forensic disciplines (e.g. fingerprints, toolmarks and ballistics), we have seen the emergence of technology-aided methodologies to minimise the risks associated with current subjective procedures (Dror, 2013c; Dror & Mnookin, 2010). In BPA, computer programs such as HemoSpat® and BackTrack™ and the use of 3-dimensional laser scanning (e.g., FARO-Scene®) can assist in the measurement of the individual bloodstains within a pattern, with the main objective being to efficiently calculate the area of origin of an impact.

While the use of technology is one potential way to reduce subjectivity in BPA, there are some limitations. For example, although these technologies might provide the possible position of a victim when a bloodletting injury was sustained, they do not necessarily address the mechanistic cause of the bloodstain pattern.

Controlling the flow of contextual information

While we consider whether or not contextual information is biasing in BPA, we cannot lose sight of the fact that some of the contextual information that analysts encounter is necessary for a comprehensive analysis. Furthermore, many forms of contextual information are simply unavoidable in the context of a full scene examination. As a consequence, considering solutions to the issue of contextual bias in BPA requires us to focus on context management, rather than context elimination.

As described earlier, there is currently no accepted protocol to distinguish between the various components of BPA. As such, the lines between pattern classification and scene reconstruction are often indistinct. This imprecision hinders discussion about which (and when) sources of contextual information are appropriate for an analysis. When considering a scene examination, analysts will generally be exposed to much of the contextual information early on, at a time when their initial task—identifying and classifying the bloodstain patterns—shouldn’t require any additional information. At this stage of the analysis, analysts could try to complete their analysis in the absence of any avoidable information (e.g., a police investigator’s hypothesis, eyewitness reports). Then, when their task requires it (i.e., for scene reconstruction), this information can be obtained and incorporated if appropriate for the investigation.
At all stages of the analysis, documentation of the decision-making process should include the way in which the analyst’s conclusions evolved alongside the flow of contextual information. That is, a person reviewing the BPA report should be able to clearly see what information was reviewed and when it was obtained, and how each piece of information contributed to the analyst’s conclusions. This documentation is especially beneficial if any of the contextual information (e.g., the pathology report) is disputed, because it may help the court to discern an analyst’s conclusion in the absence of this information.

Controlling the flow of information is less problematic when considering BPA in the laboratory—for example on clothing or through photographs. Here, information can be triaged in a way that means that analysts only encounter information that is essential to their task. While this approach may require increased resourcing, it could successfully minimise the potential for contextual bias in the laboratory.

Multiple hypothesis testing

Hypothesis testing is the basis of the scientific method. An investigator might offer a scenario to a bloodstain pattern analyst based on what a suspect or witness has reported, and ask the analyst to determine whether or not the bloodstain evidence can confirm or refute this scenario. In this way, an anchor point for hypothesis testing is created. The risk associated with this approach, however, is that the analyst might unwittingly seek, interpret, or remember information that confirms this hypothesis (Nickerson, 1998). Analysts can reduce this risk by striving to keep alternative, competing hypotheses in mind during pattern interpretation, and by performing their initial examination in the absence of this potentially biasing information.

Technical and Peer Review

Many scientists will agree that a technical or peer review of forensic reports is a critical step towards ensuring scientific rigor. As such, they incorporate reviews as standard procedure. The technical or peer review process may also serve as an opportunity for another qualified analyst to conduct an interpretation free from contextual information—a procedure sometimes referred to as “blinding.”

A blind assessment may take the form of a case/item-reanalysis, where reviewers are either unaware they that are reviewing a case/item, or know they are the reviewer but are unaware of the original analyst’s conclusions. Alternatively, the review process may incorporate some elements of blinding by shielding the reviewer from the unnecessary case information that the original analyst was exposed to. Being blind to this information increases the chances of technical reviewers “picking up” on results that may have been compromised by contextual influence. The inclusion of one or more methods of blind assessment as part of the technical review may be particularly important for those analysts who are unable to triage incoming information due to their overlapping job responsibilities.

Technical reviews with elements of blinding may be the most immediate means of addressing the effects of contextual information in BPA, but they do not come without challenges. First, for the review of bloodstain patterns at a scene, these procedures almost always rely on photographs and notes taken by crime scene personnel or the original analyst. Although the use of photographs makes it possible to shield the analyst from some of the unnecessary context from the scene, the true spatial distribution of a bloodstain pattern is difficult to assess from two-dimensional photographs. This limitation may be at least partially offset with the use of 3-dimensional imaging techniques.

Second, it can be difficult for bloodstain pattern analysts to find a truly independent peer reviewer—especially in agencies that employ only a small number of analysts. For example, a chosen reviewer might have worked on other aspects of the same case, or might possess information about the case through general discussion in the laboratory. In these cases, decisions may need to be reviewed by analysts from a different agency, despite the logistical challenges that this approach could present.
Continued Engagement with Research

Although rigorous empirical research examining the fluid dynamics of blood deposition is increasingly telling us about the behavior of blood, we still know relatively little about the behavior of those who examine it. The research picture so far depicts a problem with contextual bias in BPA; however, considerably more research is needed to work out exactly what’s going on, and how we might address this issue. An approach that draws together basic research in cognitive science as well as field studies that examine experts in the context of real casework will help to build a better picture of how the discipline can tackle contextual bias. This research is crucial if we are to develop context management procedures that are both practical and effective.

Implications for the Courtroom

Even if you remain unconvinced about contextual bias after reading this article, plan to face the issue in the courtroom. Lawyers are already up-skilling in this area (see Edmond et al., 2014), and analysts who present expert evidence should therefore be prepared to answer questions about bias on the witness stand. These questions are likely to encompass your understanding of bias (e.g., “what do you know about contextual bias, and how it relates to BPA?”), how that knowledge has shaped your practice (e.g., “what procedures does your agency take to minimize contextual effects, and were those procedures followed in this case?”), and which forms of contextual information you encountered in the case in question (e.g., “what did you know and when did you know it?”). For the time being, at least, attention to contextual bias is inescapable, and it will serve the discipline well to recognize and address this issue.

References

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The ANZFSS 23rd ANZFSS International Symposium on the Forensic Sciences

Together InForming Justice

Tena koutou, tena koutou, tena koutou katoa
Greetings and hello to you all

The 2016 ANZFSS 23rd International Symposium on the Forensic Sciences will be held in Auckland, New Zealand, 18th to 23rd September. This Symposium will bring together practitioners, experts and students from all forensic science disciplines, law enforcement and the judiciary to explore key aspects of the theme, Together InForming Justice. Bloodstain Pattern Analysis will again feature and as the IABPA Vice President for Region 6, I invite you to attend. It will be another great Symposium, and planning is well underway. In addition to being a world leader in many areas of forensic science and forensic science research, NZ is a top international tourist destination, famous for its natural beauty, indigenous Maori people and diverse Polynesian culture. Most recently, home to Lord of the Rings and the Hobbit, NZ is a tourist destination in itself. Take the opportunity to explore, be entranced and fall in love with this beautiful country.

Go to the website www.anzfss2016.org to register your interest!
Recent BPA Related Articles in the Scientific Literature


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Moving Soon?

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Applications for membership as well as for promotion are available on the IABPA website:
IABPA Website: http://www.iabpa.org

The fees for application of membership and yearly dues are $40.00 US each. If you have not received a dues invoice for 2015 please contact Norman Reeves at norman@bloody1.com. Also, apparently, non US credit cards are charging a fee above and beyond the $ 40.00 membership/application fee. Your credit card is charged only $40.00 US by the IABPA. Any additional fees are imposed by the credit card companies.

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(English)
Blutspureninstitut
Obergasse 20
61250 Usingen
Germany

Instructor: Dr. Silke Brodbeck, MD
Tel: +49-170-84 84248
Fax: +49-6081-14879

November 9-13, 2015

Advanced Bloodstain Pattern Analysis Course
Loci Forensics B.V.
Haversstraat 44
2153 GB Nieuw-Vennep
The Netherlands

Instructors: Martin Eversdijk and Rene Gelderman
Fax: +31(0)20-8907749
E-mail: Info@lociforensics.nl
December 7-11, 2015
Basic Bloodstain Pattern Analysis Course
(German)
Blutspureninstitut
Obergasse 20
61250 Usingen
Germany
Instructor: Dr. Silke Brodbeck, MD
Tel: +49-170-84 84248
Fax: +49-6081-14879

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Miami-Dade Public Safety Training Institute
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Crime Laboratory Bureau
Forensic Biology Section
9105 N.W. 25th Street
Doral, Florida
33172-1500
Voice: 305-471-3014
Fax: 305-471-3478
E-mail: twolson@mdpd.com

Articles and training announcements for the December 2015 issue of the Journal of Bloodstain Pattern Analysis must be received before November 15th, 2015
Editor’s Corner

Submission of articles for peer review and consideration for publication has improved this year and hopefully a good sign for the future. As you can see in the section, *Recent BPA Related Articles in the Scientific Literature*, there were eight interesting articles published in the major forensic journals. Unfortunately, access to those journals may not be readily available to many of our members unless they or their agency subscribes to them. The websites of these journals usually allow viewing of the abstracts of the articles but charge a fee for downloading the complete article. As a result, current BPA research and information within these articles may not be available to many BPA analysts.

The program for the upcoming 2015 IABPA Annual Training Conference in Fort Worth, Texas organized by Cele Rossi and DeWayne Morris has many interesting presentations on the schedule. The Bring Your Own Case session on Tuesday evening is available for attendees to present interesting cases. The December issue of the Journal will contain the abstracts of the presentations and workshops given in the general sessions. I invite all speakers to consider submitting their research paper or case presentation for possible future publication in the Journal.

The 2015 IABPA Annual Training Conference in Fort Worth, Texas will be the 27th with the 1st held in Denver, Colorado in 1988 according to historical data available to me. I have seen the continual growth of the organization having attended most of the conferences over the years and look forward to my attendance in Fort Worth.

Stuart H. James
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