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The Role of Logic in Bloodstain Analysis and Crime Scene Reconstruction

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John Locke in An Essay Concerning Human Understanding remarked "God has not been so sparing to men as to make them barely two legged creatures, and left it to Aristotle to make them rationale." Locke believed the study of logic and reasoning served no function, as man was a rational creature by nature.

We recognize reasoning as a skill used to resolve problems encountered daily. It provides a practical approach by which analysts weigh options and ultimately make conclusions about events they were not present to observe. The application of a raw talent may be sufficient in some instances. Yet, by refining our reasoning skills and recognizing the dynamic nature of the events we seek to explain, we strengthen our ability to define the most likely conclusions.

With this in mind, lets explore the application of logic and its purpose in bloodstain analysis. We'll touch on the subjects of predictability, inductive and deductive reasoning and some of the common fallacies encountered.

Expectations and Predications

Everyday of our lives we encounter situations in which we have expectations. We expect the sun to rise, or to receive a handshake when we offer our own. These expectations, although subjective, are based on experience. As investigators we also use expectations. The moment we walk into a crime scene our mind begins to process data. Expectations play an important role here, and may define our early conclusions.

- "The room's locked from inside, was this a suicide?"
- "That looks like a high velocity spatter pattern, wheres the gun?"

Such expectations are usually the result of study and personal experience. They provide initial momentum to our inquiry and may guide us in the investigation. So you might ask, where is the problem?

Expectations are nothing more than simple predications. As **predications**, they may prove to be without factual basis. Therefore as the situation develops the investigator must be prepared to ignore or demote his or her initial expectations, when no evidence can be found to support them.

To look further at the issue of predictability, we need to tread into the realm of physics. Limiting our ability to predict the outcome of any given set of circumstances, is the complex system concept. In Newtonian physics, most systems

were considered deterministic. Meaning, if the forces impacting on the various components of the system could be defined then future states or even previous states of that system could be determined. With the advent of quantum mechanics, this perception changed. Now, most systems are recognized as being complex. That is, the nature of the forces impacting on the system are so dynamic it is difficult to define them or their interactions in absolute detail. Although generally predictable, minor deviations in the definition of the system have the ability to create completely unexpected results.

Consider the crime scene as a system. In essence we are attempting to establish a previous state of this system through reverse engineering. Our components of concern are the victim, subject, weapon, and blood. We should be able to determine to some extent positions of these components. Velocity of the wounding agent may be inferred, while gravity and air resistance are constants. Unfortunately the nature of the larger components (e.g. exact positions of each, the angle of the weapon striking a body) leave a lot of room for error. As we cannot define in absolute detail the positions and actions of these components, our conclusions and reconstruction are likely to be limited to some general parameter of possible and impossible events.

Bloodstain pattern recreations are directly impacted by this issue. Imagine a simple hair swipe. Exactly how many hairs were bloodied, by what volume of blood? In what order and at what angle did they contact the surface involved? Given this situation, it is unlikely attempts at a recreation will produce a zerox copy of the original stain.

Deductive vs Inductive Reasoning

Sir Arthur Conan Doyle's fictional character, Sherlock Holmes, often utilized complex reasoning to reach his conclusions. In truth, the manner of reasoning used by the master of deduction was often more inductive than deductive. The distinction is of little importance in fiction. To the investigator, the difference is real.

Deductive and inductive arguments may appear on the whole as similar. There is however, a distinct and important difference in the conclusions which follow each. Deductive arguments can be defined as those in which the conclusion must logically follow from the premises. If the premises put forth are true, the conclusion must also be true.

Premises: Print A in B's blood, is on knife C.
 Print A belongs to D.

Conclusion: D was in contact with knife C after B began to bleed.

All information in the conclusion is established in the premises. The conclusion must therefore be true.

Inductive arguments on the other hand, allow for exploration by the analyst. If the premises are true, the conclusion is also likely to be true. As Morris Engel explained in his book, With Good Reason, "...the conclusion is presented as following the premises with a high degree of probability". For example:

Premises: The subject injured his hand as he fled.
 Blood drops were found outside the door
 from which the subject fled.

Conclusion: The blood drops are those of the
 subject.

On its surface, the basis for the argument is sound. If both premises are true, it is probable the conclusion is true. Yet the information contained in the conclusion is not completely established by the premises. What happens when the blood comes back from the lab identified as non-human? Not having recognized the inductive nature of the argument, the investigator might be in for somewhat of a shock.

In the analysis, we must distinguish the deductive arguments from the inductive arguments. Inductive arguments are a valuable tool for investigators, leading us to that which is not always apparent. We cannot however, allow an inductive argument to be treated as a deductive argument for this excludes possibilities and leads to unsound reasoning.

Informal Fallacies in Bloodstain Analysis

Any analysis at its heart, is an argument. Before we accept an argument, we should be clear on three things:

- What does the argument choose to establish?
- Is the evidence presented correctly, without weighting in either direction?
- Is the reasoning of the argument valid?

There are three categories of fallacies which deal with these questions: fallacies of ambiguity, fallacies of relevance, and fallacies of presumption. The last group deal with incorrect arguments disguised to look like correct arguments. Although any of the fallacies may be encountered, the presumptive fallacies tend to be more prevalent and important in our discipline.

The first presumptive fallacy we'll discuss is bifurcation. It presumes that something is either true or it is not. There is no in-between. The lawyer who asks us to "Just answer yes or no." is using this fallacy in his favor.

Imagine an argument about the origin of a spatter following a gunshot. We know that shotguns produce considerable backspatter and forward spatter under most circumstances. Having found a small stain which is consistent with a gunshot spatter, must we exclude it from

having been produced by the shotgun simply because it is not "large"? A bifurcated argument might do just that, because it is not what we normally expect. "Shotgun wounds only produce large spatter patterns." A less presumptuous position demands we look closer at the empirical data. Gunshots, to include shotguns, do occur where there is little or no spatter. Between a lot and very little reside many possibilities. As the argument is inductive, either conclusion is possible. The bifurcated argument simply attempts to force the issue.

Another fallacy of presumption is that of false cause. Consider the argument involving the subjects blood which turns out to be non-human. A causal effect was established between the injury to the subject and the blood discovered outside the residence. Consider arriving at the site of a homicide and discovering bloodstains of various types. We observe the victim and note wounds which might account for these stains. If we assume all the stains to be the result of the victims injuries, the fallacy of false cause has presented itself. We did not consider the possibility of other people (particularly the subject) having been injured and thus creating the stains. Obviously, using other evidence, we may reach the same conclusion later. At this point however, the argument is unsound.

Irrelevant thesis is another fallacy encountered. Simply stated an irrelevant thesis attempts to prove something which is not at issue. It is then offered as proof that the original argument is false.

Imagine the question: Could a particular event "A" create bloodstain "Z". The answer is likely to be put forth as a yes or no. Irrelevant thesis answers this question by offering an alternate set of circumstances "B" which could also create stain "Z".

The deceptive nature of the answer is that it offers valid information, which may be important. But the wording of the answer is veiled in such a manner as to exclude or rebut the original issue without having dealt with it at all. Whether stain "Z" could be produced by circumstance "B" says nothing to the question of whether stain "Z" was produced by circumstance "A". As such "B" does not disprove "A", in and of itself.

Putting It All Together

The limitation in our task is evident, we are seeking to look back in time! In many instances there is no one beyond the subject, who can provide details regarding what occurred. Even in situations where eye witnesses exist, the seasoned investigator realizes they often give conflicting testimony for various reasons. In the end, proper analysis of physical evidence shoulders the greatest burden of proof in establishing these past events.

An analogy related to this difficulty, was once made by an archaeologist. Discussing a dig and the conclusions drawn from it, he said "It's something like putting together a jigsaw puzzle without having access to the box. You really don't know what the picture is supposed to look like".

The same is true as we view a crime scene. Certain evidence gives us clear focus and direction. Other evidence gives us partial focus, but its relationship to the whole may not be clear. On the heels of this, comes the peripheral evidence. We recognize it has some relationship, but where and how it fits may not be understood at all. Unfortunately our boxtop isn't available either. Thus, we have no standard by which to compare our conclusions.

Often when presented with less than clear circumstances, investigators depart from logic and turn to subjective issues. Statements like "That's not logical, why would he do that?" begin to appear. It is not that we aren't concerned with motive. It is simply that attempts to assign motives to specific events and the understanding of human behavior during the crime, adds a new dimension to the term subjectivity. Once we stray to subjective issues in order to define our crime, we have lost touch with our most authoritative and valuable asset. As Herb MacDonnel put it The Evidence Never Lies.

To steer clear of these subjective traps, the analyst must first understand the application of logic, then seek to define their arguments using acceptable reasoning. Finally, they must look for logical fallacies both in their own and other's arguments. The basis of our ultimate conclusion rests on earlier conclusions made about items of evidence. Point A leads to Point B, which leads to Point C, ad infinitum..... If Point A was inferred based on poor reasoning or invalid inferences, the entire conclusion could be tainted. As such it may also be wrong and thus unacceptable. Only with concise thinking are we likely to stay the course and reach acceptable solutions.

Given the dynamic nature of our world and its interactions, no one can establish every action related to the crime with certainty. Paraphrasing Voltaire, "Only a charlatan is absolutely certain of anything". Our expectations or predications, although a valuable tool, must be recognized for their subjective nature. Being such they cannot form the cornerstone of our conclusions. The application of sound reasoning skills however, will likely help explain the majority of our evidence. For this reason, the first lesson in bloodstain analysis might best be one taught by Aristotle.

References

1. Engel, Morris S., With Good Reason: An Introduction to Informal Fallacies, St Martin's Press, New York, 1982, pg 7.
2. *ibid*, pg 11.
3. Anonymous.
Author's Note: I must apologize to the true author of this statement. I overheard the comment while watching a PBS style broadcast. I was quite struck by the concept, but failed to catch the Professor's name.