"TOTALITY OF THE EVIDENCE" OR CONTEXTUAL BIAS: WHERE DO YOU DRAW THE LINE?

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ABSTRACT

Contextual bias is an issue that has come to the forefront of forensic science in the last few years, and nowhere is contextual bias more likely to influence scientific determinations than in fire investigation. This is largely because many fire investigators also serve simultaneously as law enforcement officers.

This paper will explore the different duties, responsibilities, and ethical requirements of the scientist and the law enforcement officer. What data constitutes scientific evidence and what constitutes investigative information? Can the two be separated? Should they be separated? How does the science suffer when the scientist is influenced by contextual bias? How does law enforcement suffer when a fire investigator is unable to classify a fire based on the physical evidence?

There are no easy answers to these questions. In one case, the ethical and valid response may be obvious, while in the next case, a fire investigator attempting to assist the jury to understand the physical evidence can easily cross the line and conflate valid investigative data with scientific proof. While it is unlikely that this session will bring a final resolution to these questions, the audience will have the opportunity to engage in critical thinking about the scientific process and its place in the criminal justice system.

"SCIENTIFIC" KNOWLEDGE VERSUS "INVESTIGATIVE" KNOWLEDGE

The fire investigation profession sometime ago committed itself to conducting scientific investigations. The result has been significant improvements in the reliability of origin and cause determinations. In the intervening years, we have tried to root out those practices that make arriving at a valid scientific conclusion about the origin and cause of the fire more difficult. One of the obstacles to reaching a valid conclusion is cognitive bias. The concept of expectation bias was first introduced to NFPA 921 in the 2008 edition, when the following caution about expectation bias was added.

> **4.3.8 Expectation Bias.** Expectation bias is a well-established phenomenon that occurs in scientific analysis when investigator(s) reach a premature conclusion without having examined or considered all of the relevant data. Instead of collecting and examining all of the data in a logical and unbiased manner to reach a scientifically reliable conclusion, the investigator(s) use the premature determination to dictate their investigative processes, analyses, and, ultimately, their conclusions, in a way that is not scientifically valid. The introduction of expectation bias into the investigation results in the use of only that data that supports this previously formed conclusion and often results in the misinterpretation and/or the discarding of data that does not support the original opinion. Investigators are strongly cautioned to avoid expectation bias through proper use of the scientific method. [1]

The question then becomes, "What constitutes 'all of the relevant data'?" Relevant to what? Relevant to a reliable scientific determination, or relevant to the correct law enforcement conclusion? The two are not necessarily the same.

When fire investigators testify as expert witnesses, they are allowed the privilege of expressing an opinion to a jury, as long as that testimony meets these criteria: (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert has

reliably applied the principles and methods to the facts of the case. [2] Whether the situation is a proper one for the use of expert testimony is to be determined on the basis of assisting the trier. "There is no more certain test for determining when experts may be used than the common sense inquiry whether the untrained layman would be qualified to determine intelligently and to the best possible degree the particular issue without enlightenment from those having a specialized understanding of the subject involved in the dispute." Ladd, Expert Testimony, 5 Vand.L.Rev. 414, 418 (1952). [3]

Once he or she has qualified as an expert, and explained fire science to the jury, the members of the jury are likely to perceive anything the investigator says as scientific fact, even when that is not the case. Particularly in a case where there is one individual serving as both the scientist and the law-enforcement investigator or case agent, there exists a risk of confusion if the two roles are not distinguished.

In one of the first reliability challenges to a fire investigator serving the role of the scientist, the Eleventh Circuit expounded on the special aura of reliability that surrounds "scientific testimony."

> The use of "science" to explain how something occurred has the potential to carry great weight with a jury, explaining both why counsel might seek to couch an expert witness's testimony in terms of science, as well as why the trial judge plays an important role as the gate-keeper in monitoring the evidentiary reliability of such testimony. See Daubert, 509 U.S. at 590, 113 S.Ct. at 2795. Because of the manner in which this expert's testimony was presented to the jury, we find no error by the trial court in determining Daubert applied to the testimony at issue. [4]

The *Benfield* decision was handed down in May 1998, about a year before the Supreme Court found that *Daubert* and the Federal Rules of Evidence apply to **all** expert testimony, not just scientific testimony. In the *Kumho* decision, the Supreme Court held that the federal rules did not distinguish between "scientific," "technical," or "other specialized" knowledge. Expert testimony is expert testimony, and the court system relies on it in most cases that go to trial today. Problems can arise when expert testimony is co-mingled with other investigative information. This problem has recently been highlighted in a case before the Seventh Circuit Court of Appeals, in which it was argued that a law enforcement officer crossed the line when he attempted to put an "expert gloss" on what would otherwise be admissible fact witness testimony.

> 'Interpretations' of unambiguous words or phrases that are plainly within the jury's understanding are unlikely to be admissible under Rule 702. Expert testimony does not assist where the jury has no need for an opinion because it easily can be derived from common sense, common experience, the jury's own perceptions, or simple logic**. …**
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> The witness's dual role might confuse the jury, (citation omitted), or a jury might "be smitten by an expert's 'aura of special reliability' and therefore give his factual testimony undue weight," (Citations omitted) Experts famously possess an 'aura of special reliability' surrounding their testimony. And it is possible that the glow from this halo may extend to an expert witness's fact testimony as well, swaying the jury by virtue of his perceived expertise rather than the logical force of his testimony." (internal citation omitted)). "Or, the jury may unduly credit the opinion testimony of an investigating officer based on a perception that the expert was privy to facts about the defendant not presented at trial." (citation omitted). Alternatively, "the mixture of fact and expert testimony could, under some circumstances, come close to an expert commenting on the ultimate issue in a criminal matter.

The court went on to admonish judges to instruct juries about what testimony is expert testimony and what is not, and it further stated that prosecutors should structure their examination of a witness to allow for a separation of the expert testimony from the fact testimony when the law enforcement officer was testifying in a dual role. [5]

THE "HOLISTIC APPROACH"

In 2009, Avato and Cox published an interesting and provocative article in the *Fire and Arson Investigator* entitled "Science and Circumstance Key Components in Fire Investigation." [6] They provide two scenarios of a fire

that resulted in identical physical evidence. In the first scenario, Mr. Smith says “Hello” to his secretary, goes into his office and closes the door. He then lights a candle and discards the match in a trash can. He receives a phone call and immediately leaves the office, closing the door behind him. A fire erupts in the trash can. In the second scenario, Mr. Smythe angrily storms past his secretary ranting, “I'll fix them. They'll pay for firing me.” He then enters the office, slams the door behind him, and throws a lit match into the trash can. He exits the office and closes the door and shouts “Sic semper tyrannis.”

The authors argue that classifying the second fire as “undetermined” is a result of disregarding relevant data, and state, “This approach is not only a willful departure from scientifically based problem solving, but it is also a dangerous methodology that has most certainly led to erroneous origin and cause determinations.” But what is the data relevant to? Certainly, **the jury** is entitled to learn all of the facts uncovered during the investigation of this fire, but does that allow the investigator, using his expertise as a fire scientist, to conclude based on the scene examination that he has “scientifically” determined that the fire was intentional?

The second fire was certainly intentionally set, but no expert analysis or opinion is required to reach that conclusion. The jury needs no help in determining what happened here. Sometimes the science is not useful, nor is it necessary. In fact, presenting a perfectly logical and correct conclusion under the color of “science” might be considered disingenuous.

Avato and Cox set up several scenarios that do not describe how anyone investigates fires, but they correctly state that it is the investigator’s responsibility to find the “demarcation” between relevant scientific data and data that is not relevant. No matter how that line is drawn, it surely travels through a domain called “witness statements.” Statements that describe observations about the fire, or knowledge of the arrangement of furniture, or when the electricity was disconnected clearly belong in the relevant scientific data column. Statements about motive, means and opportunity are not relevant to an origin or cause determination, and NFPA 921 specifically states that such “data” should only be considered **after** the origin and cause have been determined.

This author was requested to examine the evidence in the case where a defendant was accused of pouring gasoline on his girlfriend and setting her on fire. The Prosecutor had heard several versions of the event and wanted an independent evaluation of the evidence. Based on the physical evidence, however, three scenarios were equally supported:

A. The defendant poured gasoline on the victim, and then he ignited it.
B. The defendant poured gasoline on the victim, and then the victim ignited it.
C. The victim poured gasoline on herself, and then she ignited it.

Scientific evaluation of the physical evidence was of no help.

In another case, the owner of a retail establishment that sold skiing equipment in the winter and swimming pool supplies in the summer, solicited several individuals to burn the store down so she could collect on her insurance policy. Finding no takers, the woman declared she would do it herself, and when her boyfriend challenged her, she wagered $500 that she would, in fact, burn the store down. And burn it did.

It burned so completely, in fact, that an investigative team consisting of five certified fire investigators, an electrical engineer, a fire protection engineer, a chemist and a canine team who spent three days on the scene were unable to determine either the origin or the cause. It took more than five years to bring the case to trial, and the lack of a demonstrated origin and cause troubled the jury. In the end, however, they did not find that there was reasonable doubt about the store owner’s guilt, and they convicted her. The investigators did the right thing by declaring, even knowing how many times the woman had solicited others to commit arson, that the origin and cause were undetermined. The jury would not have been helped by having an expert opine that the fire was intentionally set. They were able to come to that conclusion themselves, based on common sense and investigative information. This is yet another case where the scientific evaluation of the evidence was of no help. The defendant got a fair trial, and had no grounds to appeal the admission of expert testimony.

ETHICAL CONSIDERATIONS

Ethics can be defined as the science of human duty in its broadest sense. If we change the word "human" to "professional" we can define ethics for every profession, but those ethics are different for each. Scientists must live by a different set of rules than law enforcement officers. Prosecutors must live by a different set of rules than defense attorneys. One hopes that all of the players in the criminal justice system behave ethically. One of the most respected forensic scientists on the planet, Dr. Douglas Lucas, spent more than 20 years as Chairman of the Ethics Committee in the American Academy of Forensic Sciences. Dr. Lucas has written and spoken extensively on the subject of ethics. He states that one of the major causes of pressure on those who serve as expert witnesses is the adversary system of justice because of the inherent tension between the goals and methods of science and the goals and methods of litigation. This is so even though both make sense, and both serve vital social functions. In describing the different ethical obligations of scientists and law enforcement officers, Dr. Lucas writes,

> For a law enforcement officer, acting on information received from another officer is quite proper. For a scientist, however, arriving at a conclusion in the absence of proper scientific data, is quite unethical. This distinction is particularly important, and sometimes difficult, for scientists who are part of a law enforcement agency, and especially for those who are also sworn officers. [7]

The tension between science and the law was recognized by Justice Blackmun in the *Daubert* decision, when he wrote:

> …there are important differences between the quest for truth in the courtroom and the quest for truth in the laboratory. Scientific conclusions are subject to perpetual revision. Law, on the other hand, must resolve disputes finally and quickly. The scientific project is advanced by broad and wide ranging consideration of a multitude of hypotheses, for those that are incorrect will eventually be shown to be so, and that in itself is an advance. Conjectures that are probably wrong are of little use, however, in the project of reaching a quick, final, and binding legal judgment--often of great consequence--about a particular set of events in the past. We recognize that in practice, a gatekeeping role for the judge, no matter how flexible, inevitably on occasion will prevent the jury from learning of authentic insights and innovations. That, nevertheless, is the balance that is struck by Rules of Evidence designed not for the exhaustive search for cosmic understanding but for the particularized resolution of legal disputes. [8]

Dr. Lucas served on the Inspector General's Commission convened in the mid 1990s to investigate allegations of irregularities in the FBI Laboratory's Explosives Unit. At that time, the testifying experts were required to be field agents as well as scientists, and unfortunately, some of them confused the two roles.

In one instance, a chemist by the name of Rudolph conducted a preliminary examination of a suspected explosive, and got results "consistent with" PETN, the explosive used in detonator cord. He testified positively at the trial of a suspected terrorist that he was as sure as he could be that he had identified PETN, but on cross-examination, he had to admit that he was using a combination of "scientific" and "investigative" information to reach his conclusion. Detonator cord had been found in a garbage container near the defendant's residence.

At least partly as a result of the devastating cross-examination of Rudolph at the trial, the defendant was acquitted. The United States attorney was not happy. In a four-page complaint to the FBI laboratory director he wrote:

> The first deficiency in Rudolph's analysis seems obvious. Relying on the hearsay views of field agents in rendering an opinion as to the presence of a chemical compound seems obviously wrong-headed. The FBI chemist is being asked to <u>independently</u> ascertain the existence of a substance not just regurgitate information he has received from the field. Secondly, the information from the field agents may be wrong or so speculative as to be accorded little weight. Finally, using any basis other than instrumental analysis for an opinion as to the presence of a chemical or compound leads, as in this case, to insufficient instrumental testing. [9]

Because scientific testimony has the potential to carry great weight with the jury, Courts have a right to expect that testimony presented as science is based on real science that is independent of other field information. The OIG report stated, "We conclude that Rudolph's performance in Psinakis was wholly inadequate and unprofessional." The Commission did not, however find a factual basis to conclude that he intentionally overstated or biased his conclusions.

The OIG commission also investigated the laboratory's conduct in the first World Trade Center bombing. One of the problems that the prosecution had in that case was that the forensic scientists scientists who searched the bomb scene were unable to find any unreacted explosive particles, and thus they were unable to identify the main charge. A scientist named Williams, however, conducted several tests using urea nitrate, and testified that it was his scientific opinion that the main charge consisted of 1200 pounds of the substance. Here is an excerpt of the OIG report of Mr. Williams co-mingling of "investigative" and "scientific" evidence.

> At the trial Williams testified that his observations at the scene enabled him to help the court determine the explosive that may have been used in the blast. Now he has admitted that "there's no way I could have called any kind of explosive." In light of Williams' OIG testimony, we are deeply troubled that his testimony on direct examination may have misled the court.
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> In sum, we conclude that Williams' direct examination was inaccurate and misleading, and suggested too strongly that a fertilizer-based explosive like ammonium nitrate or urea nitrate was used in the Trade Center bomb.
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> **(b) Cross-Examination**
> Even more troubling than Williams' direct examination was a part of his cross-examination in which he rendered an incriminating opinion based on speculation beyond his scientific expertise. On direct, Williams identified a category of explosives that fit the VOD and damage that he observed at the post-blast scene. This category included but was not limited to urea nitrate. At his OIG interview (as discussed above), Williams was emphatic that he could not identify a specific explosive based on his observations at the crime scene.
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> Nevertheless, Williams testified on cross-examination that the bulk of the explosive was, in my opinion, urea nitrate. See also on the same page of cross-examination: I believe urea nitrate was the bulk of the constituent in that bomb with other explosive materials. At his interview we asked Williams how he could render such an opinion, and he answered: the reason I was able to do that in testimony was because I had the benefit of the search sites, the storage sites, the bomb factory and, of course, viewing the evidence from the crime scene. Williams continued:
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> OIG: And I take it from your answer, that based on your assessment of the explosive damage that you observed and was made known to you, you could not have rendered an opinion that the bulk of the explosives in this case was urea nitrate; is that correct?
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> AGENT WILLIAMS: If I had no benefit of auxiliary searches and materials, that's absolutely correct. If I just had to work with that crime scene, there's no way I could have called any kind of explosive.
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> Williams' use of the auxiliary searches to render an opinion that the bulk of the main charge was urea nitrate was improper for two independent reasons.
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> First, Williams improperly based his expert opinion that urea nitrate was the main charge on the fact that urea nitrate and other materials had been associated with the defendants. This error is analogous to the one Rudolph made in Psinakis when he relied on the fact that stripped detonating cord had been found outside the defendant's house as a basis for his identification of PETN on a knife. See Part Three, Section A, supra. By basing his opinion on the collateral evidence associated with the defendants, Williams improperly engaged in speculation beyond his scientific expertise.

Williams portrayed himself as a scientist and rendered opinions as an explosives expert. As such, he should have limited himself to conclusions that logically followed from the underlying data and the scientific analyses performed. Here, Williams' scientific analysis of the cause of the explosion rested on an examination of the damage at the post-blast scene. He should not have based his opinions, in whole or in part, on evidence that was collateral to his scientific examinations, even if that evidence was somehow connected to the defendants. For Williams to identify the main charge as urea nitrate based on evidence that the defendants had or could make that compound is comparable to a firearms expert identifying the caliber of a spent bullet based on the mere fact that a suspect had a handgun of a particular caliber.

Earlier in the cross-examination Williams rejected defense counsel's suggestion that Williams was trying to infer that the items seized at the locations associated with the defendants must have been the items that were used in the World Trade Center (emphasis added). Williams testified then that he was only saying that the items seized could have been used in the Trade Center explosion. This was a valid scientific assessment of the defendants' capability and an appropriate rejection of the suggestion that the cause of the explosion could be determined scientifically from the evidence associated with the defendants. Williams should have maintained this approach throughout his cross-examination.

Evidence associated with the defendants is logically relevant to the blast's cause only under the following chain of reasoning:

(1) Urea nitrate crystals and ingredients were found at locations associated with the defendants.
(2) Defendants committed the World Trade Center bombing.
(3) When defendants committed the crime, they must have used what was available to them, which was urea nitrate.
(4) Hence, urea nitrate must have been used at the Trade Center.

This chain of reasoning is objectionable because it is not scientific and because it uses a presumption or inference of guilt (point two) as a building block in the analysis. The question of the defendants' guilt is the ultimate issue. It should not be presumed as a foundation for further analysis. By basing his urea nitrate opinion on the collateral evidence, Williams implicitly accepted as a premise the prosecution's theory of guilt. This was improper.

Moreover, even assuming defendants committed the bombing and had the capacity to make a urea nitrate bomb, that did not necessarily mean urea nitrate was used at the Trade Center: the defendants, for example, may have disposed of the urea nitrate elsewhere and used another explosive in the bomb, or they may have converted the urea nitrate to nitro urea and used that explosive. Williams' opinion based on the collateral evidence was thus not only unscientific but also speculative, and it therefore fell well below the minimum standards required of competent forensic scientists.

Finally, because Williams failed to reveal that his urea nitrate opinion was based not on his independent scientific examination but on speculation from the mere fact that defendants could have made urea nitrate, the court was unable to put the opinion in its proper perspective, and a danger arose that the opinion would be given undue weight in support of the prosecution's case.

Second, the context of the questioning that led to Williams' identification of urea nitrate appears limited to an opinion based only on Williams' assessment of the damage at the crime scene. On direct examination Williams' opinion regarding the type of explosive used was explicitly [b]ased on the damage and [his] estimated velocity of detonation. It is obvious that the applicable cross-examination was an attempt to get Williams to repeat what he said on direct examination, which defense counsel misunderstood. See, e.g.: Correct me if I'm wrong. If I understood you correctly, you indicated . . . . Moreover, defense counsel, in the applicable cross-examination, explicitly asked about the possible bomb that could have caused this kind of damage. . . . [W]as whatever caused it [the damage] just this one possibility or were there other possible bombs as well . . . ?

> The court's questions about ANFO, moreover, make clear that the court believed the applicable examination related to Williams' assessment of the damage at the scene. Further, Williams' ready affirmative answer to the court's question Could it be ANFO? Suggests Williams understood that the inquiry related to the damage at the scene.
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> It must be remembered that establishing that the explosive used at the World Trade Center was urea nitrate was extremely damaging to the defendants' case. Evidence linked the defendants to a bomb factory and storage facility containing evidence of urea nitrate or the ingredients for urea nitrate, an explosive rarely used in a criminal device. Williams' testimony on cross-examination, therefore, that the bulk of the explosive was, in my opinion, urea nitrate was very incriminating.
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> In this context, it was unprofessional and misleading for Williams, without explanation, to base such an incriminating opinion on a factor (the auxiliary searches) so different from the factors previously relied on (velocity of detonation and damage at the scene).
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> In sum, when Mr. Campriello asked Williams, Could it have been another kind of bomb or no? , the question, reasonably interpreted, meant: Could it have been another kind of bomb or no, based on your expert analysis of the damage at the crime scene? In any event, even if the questioning was inept, Williams had an obligation to restrict his opinions to his scientific analysis and to refrain from speculating about what the main charge must have been based on the defendants' capacity to manufacture a particular explosive. Williams' answer to Campriello's question should have been compatible with the answer he gave us: [The main explosive] could have been anything. We conclude that by answering instead, [T]he bulk of the explosive was, in my opinion, urea nitrate, Williams failed in his responsibility to provide the court with an objective, unbiased expert opinion. [10]

Despite (or perhaps because of) the misleading evidence provided by Agent Williams, the defendants were convicted, and the "unprofessional and misleading" testimony did not result in the convictions being overturned. The Inspector General's report goes in to great detail on the two cases discussed above as well as several others. It is very interesting reading for anyone who seeks to find the line of demarcation between science and police work. In general, the OIG investigation found very few problems with the FBI's approach to science, but because a very few examiners behaved in an unethical manner in a relatively small number of cases, over 3,000 major criminal cases were cast into doubt and the otherwise well-deserved excellent reputation of a fine organization was tarnished.

CONCLUSION

Law enforcement is an important and honorable profession. It plays a central role in keeping a civilized society civilized. But it is not science. Legal "proof" and scientific "proof" are different. Nor is the problem of finding or failing to find the demarcation between scientific and investigative data confined to law enforcement. Cognitive biases are a human condition that afflict both the public and the private sector, both prosecution and defense investigators.

This author has previously suggested means to minimize expectation bias in fire cases by separating the duties of the principal investigator from the fire scene analyst. This methodology, which involves protecting the scene investigator from potentially biasing information, has been applied successfully. [11] Law enforcement officers can use science to aid in the search for justice, but if the science is to be used fairly and effectively, it is important that scientific evidence be reliable and independent.

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