Contextual Bias in Fire Investigations: Scientific vs. Investigative Data

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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 article 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, but domain irrelevant, investigative data with scientific proof. It is up to counsel to help the expert witnesses delineate between information that can potentially bias the interpretation of the physical evidence, and information that is necessary for its objective evaluation.

"Scientific" Knowledge vs. "Investigative" Knowledge

The fire investigation profession some time ago committed itself to conducting scientific investigations. The result has been a significant improvement in the reliability of origin and cause determinations. In the intervening years, the "relevant investigative community," represented by the National Fire Protection Association (NFPA) Technical Committee on Fire Investigations, has 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: Guide for Fire and Explosion Investigations* 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) uses the premature determination to dictate investigative processes, analyses, and, ultimately, 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 of fact.

> "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."[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.

A fire investigator's core competency is determining *where* the fire started. Recent studies have shown that the error rate for this important task may be shockingly high.[4] And knowledge that the homeowner was behind on his or her mortgage or recently had an argument with his or her spouse are facts that are not the least bit relevant to the task.

In *Michigan Millers Mutual Insurance Corp. v. Benfield*, one of the first reliability challenges to a fire investigator serving in the role of the scientist, the Eleventh Circuit Court of Appeals 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

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[1] NFPA 921: GUIDE FOR FIRE AND EXPLOSION INVESTIGATIONS 20 (2014).
[2] FED. R. EVID. 702.
[3] FED. R. EVID. 702 advisory committee's note (quoting Mason Ladd, *Expert Testimony*, 5 VAND. L. REV. 414, 418 (1952)).
[4] Steven W. Carman, Paper Presented at the Interscience Communications 2009 Fire and Materials Conference, San Francisco, Cal.: Progressive Burn Pattern Development in Post-Flashover Fires (Dec. 2008), *available at* www.carmanfireinvestigations.com/publications.html.

> gate-keeper in monitoring the evidentiary reliability of such testimony. *See Daubert*, [509 U.S. 579, 590 (1993)]. 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.[5]

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 *Kumho Tire Co. v. Carmichael*, the Supreme Court held that the federal rules did not distinguish between "scientific," "technical," or "other specialized" knowledge.[6] 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 comingled with other investigative information. This problem was recently highlighted in a case decided by 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, or a jury might be smitten by an expert's "aura of special reliability" and therefore give his factual testimony undue weight. 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. 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. 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.[7]

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.[8]

The "Holistic Approach"

In 2009, two ATF-certified fire investigators, Steven Avato and Andrew Cox, published an interesting and provocative article in the *Fire and Arson Investigator* entitled "Science and Circumstance: Key Components in Fire Investigation." They provide two scenarios of a fire that

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[5] 140 F.3d 915, 920 (11th Cir. 1998).
[6] 526 U.S. 137 (1999).
[7] United States v. Christian, 673 F.3d 702, 710–12 (7th Cir. 2012) (citations omitted) (internal quotation marks omitted).
[8] *Id.* at 712–13.

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!"[9]

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."[10] 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 or her expertise as a fire scientist, to conclude based on the scene examination that he or she 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 requires no assistance 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

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[9] Steven J. Avato & Andrew T. Cox, *Science and Circumstance: Key Components in Fire Investigation*, FIRE & ARSON INVESTIGATOR (Int'l Ass'n of Arson Investigators), Volume 59, No 4 Apr. 2009, at 47

[10] *Id.* at 47.

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.[11]

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

> [T]here 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.

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[11] Douglas Lucas, Presentation to the Canadian Association of Forensic Scientists, Toronto, Ont.: Forensic Science and Ethics—An Essential Association (Dec. 1, 2010).

> 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.[12]

Dr. Lucas served on the Office of Inspector General's (OIG'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 *independently* 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.[13]

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."[14] The commission did not, however, find a factual basis to conclude that he intentionally overstated or biased his conclusions.

The OIG also looked into the analysis of evidence in the first World Trade Center bombing in 1993. In that case, an FBI chemist named Williams opined that the main charge was 1,200 pounds of urea nitrate, not because it was found at the scene, but because it was found at a

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[12] Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 596–97 (1993).

[13] Letter from Ben Burch, Assistant U.S. Attorney, to John Hicks, FBI Lab. Dir. (July 8, 1989), *quoted in* USDOJ/OIG, THE FBI LABORATORY: AN INVESTIGATION INTO LABORATORY PRACTICES AND ALLEGED MISCONDUCT IN EXPLOSIVES-RELATED AND OTHER CASES pt. 3.A.II.A. (1997) [hereinafter FBI LABORATORY INVESTIGATION REPORT], *available at* www.justice.gov/oig/special/9704a/.

[14] FBI LABORATORY INVESTIGATION REPORT, *supra* note 13, at pt. 3.A.II.B.5.

bomb factory associated with the defendants, and it would take 1,200 pounds of the explosive to cause the damage to the building. The OIG asked Williams to justify his testimony, and he could not. It was based entirely on contextual bias. The OIG report stated, "Williams failed in his responsibility to provide the court with an objective, unbiased expert opinion."[15]

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.

Other Examples of Context Bias

Dr. Itiel Dror is one of the world's leading experts on contextual bias. After the Brandon Mayfield fingerprint fiasco, Dror conducted an experiment to test the effect of context bias on five fingerprint examiners. A different pair of fingerprints was prepared for each of the expert participants. Each pair of prints had been previously identified as a match by that same expert five years earlier, within the normal course of his or her work. The latent fingerprints had been obtained from the crime scenes and were all presented again to the experts in their original format. They were told that the pair of prints was the one that was erroneously matched by the FBI as the Madrid bomber, thus creating an extraneous context that the prints were a nonmatch. Three of the five examiners changed their identification to "nonmatch." One changed to "inconclusive," and only one held to the original "match" determination.[16]

The Texas Forensic Science Commission (FSC) spent three years (2008–2011) studying the science, and the lack thereof, that contributed to the exoneration of Ernest Ray Willis and the wrongful execution of Cameron Todd Willingham in 2004. In April 2011, the FSC issued its report, which discussed the cognitive biases to which fire investigators (and all forensic scientists) are subject. The FSC stated, "cognitive biases are not the result of character flaws; instead, they are common features of decision-making."[17] One of the key recommendations, of 17 made by the FSC, was enhanced admissibility hearings in all arson cases. It is at such a hearing that the potentially biasing "data" that may have influenced the investigator's determination of arson can be explored.[18] For an attorney on either side of an arson case, this report should be required reading.

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. Lawyers are also not scientists. All have different ethical obligations. 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 fire investigators or to law enforcement. Cognitive biases are a human condition that afflict both the public and the private sector, and both prosecution and defense attorneys.

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[15] *Id.* at pt. 3.C.II.B.

[16] Itiel E. Dror et al., *Contextual Information Renders Experts Vulnerable to Making Erroneous Identifications*, 156 FORENSIC SCI. INT'L 74 (2006).

[17] TEX. FORENSIC SCI. COMM'N, WILLINGHAM/WILLIS INVESTIGATION 37 (2011), *available at* www.fsc.texas.gov/sites/default/files/FINAL_1.pdf.

[18] *Id.* at 48–49.

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.[19] 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.

[19] John Lentini, Paper Presented at the 3rd International Symposium on Fire Investigations Science and Technology (ISFI), Sarasota, FL: Toward a More Scientific Determination: Minimizing Expectation Bias in Fire Investigations (2008), *available at* www.firescientist.com/publications.php.