FOLKLORE AND FORENSICS: THE CHALLENGES OF ARSON INVESTIGATION AND INNOCENCE CLAIMS

By Parisa Dehghani-Tafti and Paul Bieber***

I. INTRODUCTION: THE FOLKLORE OF FIRE FORENSICS

On a cold December night in 2013, firefighters at the White Earth Reservation in north-western Minnesota were pumping water into the charred remains where a small farmhouse had stood just hours before.[1] What was left of the structure bore little resemblance to the house it once was. The small second-floor bedroom was destroyed, consumed by flames and collapsed onto the floor of the living space below. On the first floor, only a couple of badly burned partial exterior walls to the kitchen and dining room still stood. The rest of the house had been gutted by fire, either having burned completely or fallen through a hole

[1] *See* K. Mahle, *Investigation Report*, State Fire Marshal Division, Department of Public Safety, Case Number 2013-392 (7/14/2014), in the case of *United States v. Jones*, No. 14-cr-148, 2015 WL 927357 (D. Minn. Mar. 4, 2015) (report on file with authors).

that had been burned through the living room floor into the basement. Amongst the burned debris in the basement was a smoldering couch, reduced to its broken wooden frame and metal springs. And next to the couch, hidden amongst the embers still smoldering in the basement, was the body of Shanlonda Clark.

When the fire investigator from the State Fire Marshal's Office arrived on the scene, the smoke was still rising. The small farmhouse and everything in it had burned, quite literally, to the ground. Undeterred by the paucity of evidence, the investigator was confident that he could determine where and how the fire began. He thought he had key pieces of information that helped to make order out of the chaos: he already knew where the fire started, he already knew who started it, and he already knew why. He had the answers to these questions before he ever stepped foot onto the fire scene. Now all he had to do was prove it.

The alleged arsonist in this case, like many other defendants in arson cases, was convicted in large part due to a fire investigator's expert testimony about the origin and cause of the fire. It was seemingly based on an independent, objective, and scientific examination and analysis of the physical fire-scene evidence, conducted through well-developed and accepted standardized procedures.

In truth, it is common for fire-scene analysis to rely on unmeasured and untested forensic methodologies masquerading as science. Although some particularly unreliable and out-of-date techniques have been largely rejected by modern fire investigators,[2] leading to an improvement in fire investigation overall, several well entrenched and equally concerning practices remain.

In a perfect world, a forensic examination—whether it is of a fingerprint or a fire-scene—would be conducted by a neutral, expert observer, examining all of the relevant evidence, using well calibrated instruments, and confirmed techniques leading to reliable and accurate conclusions.

Fire investigations are never conducted in such a world. A typical fire investigation relies upon subjective analyses based on emotionally charged, irrelevant, and potentially biasing information. Often, the forensic fire scene examiner tasked with determining the origin and cause of the fire is doing double-duty, simultaneously leading the criminal arson investigation to establish a motive and identify a suspect. In many cases, it is difficult to recognize where the forensic fire investigation stops and the criminal arson investigation begins.

This mix of a subjective analysis, exposure to irrelevant and potentially biasing information, and an investigator who is both forensic examiner and criminal detective, combines to form a toxic investigative environment. Under these circumstances, the forensic discipline of fire origin and cause determination disintegrates from an objective application of the scientific method into an entirely faith-based endeavor.

---

[2] *See generally* John J. Lentini, *The Evolution of Fire Investigation and Its Impact on Arson Cases*, 27 CRIM. JUST. no. 1, Spring 2012, at 12.

In essence, fire investigation is a forensic discipline with no internal mechanism to limit the conditions under which its core methodologies are applied, where an unverified statement of a witness can be translated by the fire investigator into a final conclusion, where expert opinions are often based on a complete lack of physical evidence, and where the investigator—acting both as a forensic examiner and a criminal investigator—is routinely called upon to testify to matters entirely outside his expertise. As a result, conclusions in fire investigations are primed for error, bias, and exaggeration, potentially leading to a whole new generation of wrongful arson convictions.

Once convicted, the victims of this form of junk-science have virtually no path to prove, whether through direct appeals or through collateral review, that they are innocent. As of this writing, well over 1,800 innocent individuals have been exonerated,[3] 344 by DNA alone;[4] by the time of publication, no doubt there will be more. This means that there remain countless individuals locked behind bars for crimes they did not commit. We know this because the DNA exonerations represent only those cases in which physical evidence was collected, preserved, located, and usable years or decades after the crimes. Thus, logic compels us to conclude that there remain other innocent individuals that are imprisoned whose cases simply lack the physical evidence that might exonerate them.

And yet, none of the post-conviction remedies within our criminal justice system—not direct appeals, not habeas review, not actual innocence claims—are designed to give incarcerated individuals a meaningful path to prove their innocence in the absence of physical evidence. This is particularly true for those convicted of arson crimes because by its very nature, arson is a crime in which often there is little or no clear physical evidence to speak of; the analysis of the remaining evidence is remarkably subjective; and the misidentification of an accidental fire as arson is dangerously easy and surprisingly common.[5] How, then, do we correct wrongful arson convictions?

Currently, our criminal justice system distributes the risk of wrongful convictions in a manner that—after conviction and assuming a measure of due process—overwhelmingly values finality and comity over justice and innocence. The calculus that procedural due process, comity, and finality should prevent us from aggressively adopting systemic reforms to make it easier for these

---

[3] *The National Registry of Exonerations*, U. MICH. L. SCH., http://www.law.umich.edu/special/exoneration/Pages/browse.aspx (last visited Nov. 3, 2016).

[4] *The Cases*, INNOCENCE PROJECT, http://www.innocenceproject.org/all-cases/#exonerated-by-dna (last visited Nov. 3, 2016).

[5] *See generally* PAUL BIEBER, ARSON RES. PROJECT, ANATOMY OF A WRONGFUL ARSON CONVICTION: SENTINEL EVENT ANALYSIS IN FIRE INVESTIGATION, http://thearsonproject.org/charm/wp-content/uploads/2014/08/wrongful_convictions.pdf (last visited Nov. 3, 2016) (estimating that approximately two-thirds of wrongful arson convictions resulting in an exoneration involved unreliable forensic methodologies leading to an undetermined or accidental fire being misidentified as arson).

wrongfully convicted individuals to use new scientific evidence to prove their innocence seems both morally repugnant and dangerously atavistic.

The below Article proceeds in four parts: Part I offers a detailed analysis of the basics of forensic fire investigation. Part II examines the tension between the forensic discipline of fire investigation, which seeks to determine the origin, cause, and development of a fire, and the criminal investigation of arson, which purports to establish who started the fire and why. Part III analyzes the unique and substantial risks of wrongful convictions posed by arson investigation, and how those risks are magnified by a criminal judicial system that makes it virtually impossible for defendants to claim innocence in the absence of biological evidence—even when their convictions are based on investigative methods below rudimentary standards of science—because it favors comity and finality above all else. Part IV proposes a set of systemic scientific reforms designed to establish rigorous forensic methods and eliminate potential biases during fire investigations and another set of systemic legislative reforms that provide procedural and substantive remedies for innocent individuals to challenge their convictions on the basis of bad science.

II. BACKGROUND: THE SCIENCE OF FIRE INVESTIGATION

To understand just how easy it is to misidentify an accidental fire as arson, one must simply look to the standards (or lack thereof) imposed upon the fire investigator, the underlying limitations of the forensic discipline itself, and the fire investigator's willingness to submit to those standards and acknowledge those limitations.

A. Lack of an Enforceable Professional Standard

Until the early 1990s, the fire investigation community lacked a cohesive standard of care. Procedures for conducting a comprehensive origin and cause investigation were taken from a variety of separate books and publications.[6]

In 1992, the National Fire Protection Association ("NFPA") released its first edition of *NFPA 921: Guide for Fire and Explosion Investigations* ("NFPA 921").[7] NFPA 921 was developed to assist fire investigators throughout the United States in the investigation and analysis of fire incidents and to aid in

---

[6] *See generally* JOHN F. BOUDREAU ET AL., ARSON AND ARSON INVESTIGATION: SURVEY AND ASSESSMENT (1977); FRANCIS BRANNIGAN, RICHARD BRIGHT & NORA JASON, FIRE INVESTIGATION HANDBOOK (1980); INT'L FIRE SERV. TRAINING ASS'N, FIRE CAUSE DETERMINATION (1st ed. 1982); PAUL KIRK, FIRE INVESTIGATION (1969).

[7] NAT'L FIRE PROT. ASS'N, NFPA 921: GUIDE FOR FIRE AND EXPLOSION INVESTIGATIONS (2014), [hereinafter NFPA 921] http://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards?mode=code&code=921&tab=about.

drawing conclusions and rendering opinions as to the origin and cause of fires.[8] NFPA 921 presented the first established guidelines and recommendations for the systematic investigation and analysis of fire incidents and contains specific procedures to assist in the collection and analysis of evidence.

NFPA 921 emphasizes an understanding of fire behavior, fire pattern analysis and the scientific method as the underpinnings of a comprehensive and objective origin and cause investigation.[9] The emphasis it places on adherence to the scientific method cannot be overstated. The guide lists and then elaborates on the seven required steps of a repeating cycle of observation, hypothesis, experimentation, and verification.[10] These steps include: (1) Recognize the need (identify the problem); (2) Define the problem; (3) Collect data; (4) Analyze the data; (5) Develop a hypothesis; (6) Test the hypothesis; and (7) Select a final hypothesis.[11]

While its influence within the fire investigation community has steadily grown, widespread acceptance of NFPA 921 was not immediate. Many fire investigators countered NFPA 921's scientific approach with a culture that believed fire investigation was more *art* than *science.*[12]

In 1993, the Supreme Court held in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*[13] that the Federal Rules of Evidence assign to the trial judge the task of ensuring that scientific testimony both rests on a reliable foundation and is relevant to the task at hand. The Court also explained that in order to make a determination regarding the reliability of a particular scientific theory or technique, a trial judge should rely on such factors as testing, peer review, error rates, and "acceptability" in the relevant scientific community.[14]

In the 1996 case of *Michigan Millers Mutual Insurance Corp. v. Benfield*,[15] the International Association of Arson Investigators ("IAAI")[16] filed

---

8 For more information on the history and scope of NFPA 921, including access to current and past editions, see *id.*

9 *Id.*

10 *Id.* at 17.

11 *Id.*

12 *See, e.g.*, Lentini, *supra* note 2.

13 509 U.S. 579 (1993).

14 *Id.*

15 140 F.3d 915 (11th Cir. 1998) (questioning if the trial judge in a civil arson case incorrectly applied *Daubert v. Merrell Dow Pharmaceuticals, Inc.* when excluding the plaintiff's expert fire investigator's testimony. The Eleventh Circuit upheld the trial court's decision to exclude the expert testimony on the basis that it did not comply with the scientific method.).

16 The International Association of Arson Investigators ("IAAI") is one of two large professional organizations in the United States providing training and certification to fire investigators, and offers the Certified Fire Investigator ("CFI") designation. The National Association of Fire Investigators ("NAFI") offers the Certified Fire and Explosion ("CFEI") designation.

an amicus curiae brief in which it claimed that fire investigation expert testimony should not be held to the standards developed under *Daubert* because fire investigation is "less scientific."[17]

Three years later, in 1999, the Supreme Court ruled in *Kumho Tire Co. v. Carmichael*,[18] that a judge's *Daubert* obligations to determine the admissibility of scientific testimony extended to all forms of expert testimony.[19] *Kumho Tire* marked the beginning of a broader acceptance of NFPA 921 amongst fire scientists and forensic engineers engaged in fire investigation, but investment by fire investigators still lagged behind.

By 2000, NFPA 921 had gained broad acceptance in the scientific community, but fire investigators in the field were still resistant. It was not until the 2000 publication of *U.S. Department of Justice, Fire and Arson Scene Evidence: A Guide for Public Safety Personnel*, which described NFPA 921 as "a benchmark for the training and expertise of everyone who purports to be an expert in the origin and cause determination of fires," that fire investigators began to grudgingly accept the importance of NFPA 921.[20]

Along with the gradual acceptance of NFPA 921 by fire investigators came an equally slow acknowledgement by fire investigation instructors that NFPA 921 should be used as a core document in curriculum development. After the publication of the DOJ report, with each new edition of NFPA 921, local, state, and national fire investigation curriculums were incrementally adjusted to reflect the changing procedures in fire investigation methodology. As the document's influence grew, fire investigation course curricula slowly began to reflect a better understanding of the importance of the scientific method and the fire phenomenon known as "flashover."[21]

In 2007, the curriculum of the National Fire Academy's basic fire investigation course, *Fire/Arson Origin and Cause Investigation*, experienced a significant revision with the assistance of the U.S. Department of Justice's Bureau of Alcohol, Tobacco, Firearms, and Explosives ("ATF"). This new curriculum included a module entitled "Myths and Legends" specifically designed to debunk some of the misconceptions associated with the

---

17 Brief for International Ass'n of Arson Investigators as Amici Curiae, Mich. Millers Mut. Ins. Corp. v. Benfield, 140 F.3d 915 (11th Cir. 1998) (on file with authors); *see also Fire Investigation Not Junk Science*, INVESTIGATION PROCESS RES. RESOURCE SITE (Nov. 16, 1997) http://www.iprr.org/reviews/IAAI.html.

18 526 U.S. 137 (1999).

19 *Id.*

20 U.S. DEP'T OF JUSTICE: NAT'L INST. OF JUSTICE, FIRE AND ARSON SCENE EVIDENCE: A GUIDE FOR PUBLIC SAFETY PERSONNEL 6 (2000), https://www.ncjrs.gov/pdffiles1/nij/181584.pdf.

21 *See* NFPA 921, *supra* note 7, at 16 ("[F]lashover" is the transition from a condition where the fire is dominated by burning of the first item ignited (and nearby items subject to direct ignition) to a condition where the fire is dominated by burning of all items in the compartment); *see also id.* at 43–47 (explaining the development of flashover and the impact of flashover and full-room-involvement on area of origin determination).

interpretation of burn patterns and to reinforce a reliance on the scientific method.[22]

Despite the eventual broad acceptance of NFPA 921 as the de facto standard of care in fire investigation in state and federal courts,[23] it was not until 2013 that IAAI gave a guarded endorsement of the importance of NFPA 921. In a January 2013 position statement, the IAAI acknowledged that NFPA 921 is "widely recognized as an authoritative guide for the fire investigation profession."[24] It went on to say that NFPA 921 is "an important reference manual, and sets forth guidance and methodology regarding the determination of the origin and cause of fires," but stopped short of describing NFPA 921 as a "standard of care."[25]

The difference between "offering guidance" and being a "standard of care," has a particular significance within the fire investigation community, and IAAI's avoidance of the use of the word "standard" in describing NFPA 921's role is not an oversight. Many fire investigators will quickly point out that compliance with a guide, such as NFPA 921, is voluntary, and that by its very title, NFPA 921 falls short of being a required standard.

Regardless of the fact that courts across the country have held NFPA 921 in a higher regard,[26] the distinction fire investigators make between a guide and a standard raises a troubling question: If NFPA 921 is simply a guide that can be followed or ignored at the discretion of the fire investigator, then what standards

---

[22] *See Fire Investigation: Essentials R0206*, U.S. FIRE ADMIN., https://apps.usfa.fema.gov/nfacourses/catalog/details/38 (last visited Nov. 10, 2016).

[23] Workman v. AB Electrolux Corp., No. 03-4195, 2005 U.S. Dist. LEXIS 16306 (D. Kan. Aug. 8, 2005); TNT Rd. Co. v. Sterling Truck Corp., No. 03-37-B-K, 2004 U.S. Dist. LEXIS 13463 (D. Me. July 19, 2004); Ind. Ins. Co. v. Gen. Elec. Co., 326 F. Supp. 2d 844 (N.D. Ohio 2004); Tunnell v. Ford Motor Co., 330 F. Supp. 2d 707 (W.D. Va. 2004); McCoy v. Whirlpool Corp., 214 F.R.D. 646 (D. Kan. 2003); Royal Ins. Co. of Am. v. Joseph Daniel Constr., Inc., 208 F. Supp. 2d 423 (S.D.N.Y. 2002); Snodgrass v. Ford Motor Co., No. 96-1814, 2002 U.S. Dist. LEXIS 13421 (D.N.J. Mar. 28, 2002); Chester Valley Coach Works v. Fisher-Price, Inc., No. 99 CV 4197, 2001 U.S. Dist. LEXIS 15902 (E.D. Pa. Aug. 29, 2001); Travelers Prop. & Cas. Corp. v. Gen. Elec. Corp., 150 F. Supp. 2d 360 (D. Conn. 2001); Abon, Ltd. v. Transcon. Ins. Co., No. 2004-CA-0029, 2005 WL 1414486 (Ohio Ct. App. June 16, 2005); State v. Schultz, 58 P.3d 879 (Utah Ct. App. 2002).

[24] *NFPA 921/1033 Position Statement*, INT'L ASS'N ARSON INVESTIGATORS INC., https://www.firearson.com/NFPA-9211033-Position-Statement/Default.aspx (last visited Nov. 3, 2016).

[25] *Id.*

[26] *See McCoy*, 214 F.R.D. at 653 ("The 'gold standard' for fire investigation is codified in *NFPA 921*, and its testing methodologies are well known in the fire investigation community and familiar to the courts."); *see also* Werth v. Hill-Rom, Inc., 856 F. Supp. 2d 1051, 1060 (D. Minn. 2012) (where the court excluded expert fire investigator testimony due to the expert's failure to rely on NFPA 921: "Simply put, the experts' failure to disclose their reliance on NFPA 921—in their initial Report, their Supplemental Report, their depositions, or at any other point in discovery—would alone justify excluding their opinion").

actually exist within the field of fire investigation to control or limit the methodologies, processes, or techniques used in forming expert conclusions regarding the origin or cause of a fire?[27] The simple answer is that there are none.[28] This answer is troubling both for pre-trial defendants accused of arson and post-conviction appeals for those who maintain their innocence.

B. The Process of Gathering and Interpreting Fire-Scene Evidence Is Filled with Human Error

While the guidance provided by NFPA 921 and scientific advances in our understanding of fire behavior have begun to move the field of fire investigation towards a more respected and scientific footing, several well-entrenched current practices in fire investigation keep it firmly tethered to the past. These practices effectively prevent today's fire investigators from being regarded by the broader forensic science community as real forensic practitioners, and prevent fire investigation from being accepted as a true forensic discipline.

When a fire burns, a great deal of evidence is damaged or destroyed. Traditional forms of physical evidence, such as trace evidence, DNA, and fingerprints, are often rendered unusable. However, as the heat of the fire diminishes the value of some types of evidence, the fire itself creates a unique class of evidence that has been used in determining the fire's origin and cause.

The examination of the evidence created by the fire, which includes interpreting fire patterns and burn damage to determine how the patterns were created, is termed "fire pattern analysis."[29] Through this process, and with an understanding of the predictable dynamics and behavior of fire, a fire investigator may begin to understand how the fire developed.[30]

However, fire pattern and dynamics analysis does not identify a suspect, determine a motive, or even establish if a crime has occurred; these methods of forensic examination are simply used to try to determine where the fire began (its "area of origin") and the physical circumstances that caused it (its "cause").

---

[27] *See* Russell v. Whirlpool Corp., 702 F.3d 450 (8th Cir. 2012) ("NFPA 921 qualifies as 'a reliable method endorsed by a professional organization,' . . . but we have not held NFPA 921 is the *only* reliable way to investigate a fire. Our NFPA 921 cases stand for the simple proposition an expert who purports to follow NFPA 921 must apply its contents reliably." (citations omitted)).

[28] The methodologies, standards, and practices discussed in this Article focus on fire-scene examination and the techniques employed by the fire-scene investigator in determining the origin, cause, and development of a fire. Other areas in the field of fire investigation, particularly fire debris analysis based on Gas Chromatography/Mass Spectrometry ("GC/MS") analysis and other techniques of analytical chemistry, are more firmly grounded in science and do not suffer from the same lack of standard protocols.

[29] NFPA 921, *supra* note 7, at 48.

[30] *Id.* at 15.

1. Origin Determination: The Flawed Processes for Gathering and Interpreting Evidence

In a forensic fire scene examination, by far the most important determination is the area of origin—where the fire began. Only after the area of origin is accurately defined can an examination be undertaken to identify what possible ignition sources, in or near that area, may have caused the fire.[31] As a result, the core competency of a fire scene investigator is to reliably and accurately determine the area of origin of a fire.

There are four generally accepted techniques for acquiring information that may assist in the determination of the fire's area of origin, each with their own strengths and limitations: fire pattern analysis, fire dynamics analysis, arc mapping, and witness statements.[32]

i. Fire Pattern and Fire Dynamics Analysis

The first two techniques for determining the origin of a fire—fire pattern and fire dynamics analysis—are inextricably linked and therefore may be considered together.[33] The most common method used by fire investigators to determine the area of origin is "fire pattern analysis." In this process, an investigator examines and interprets the shape, depth, texture, location, and overall appearance of the effects and patterns made by the heat of the fire on walls, ceilings, floors, or furniture, and tries to understand how the patterns were created.[34]

If accurately interpreted, this analysis can provide the fire investigator with valuable information regarding the location of the burning item or items that created the patterns. The knowledge gained from fire pattern and fire dynamics analysis can be used to determine the fire's growth and progression. NFPA 921 explains the basic concepts of fire behavior and lists various common fire patterns and effects created in normal room fires, including "V-patterns," depth of char, lines of demarcation, soot and smoke deposits, and others.[35]

When a fire grows and several items burn simultaneously, each creating its own burn patterns, fire pattern analysis becomes more complicated. General

---

31 *Id.* at 186.

32 *Id.*

33 Although NFPA 921 lists *fire patterns* and *fire dynamics* as separate sources of information, the two methods of data acquisition are intertwined. The physics and chemistry of fire ignition and growth (fire dynamics) are what result in the fire patterns to be analyzed, while the fire patterns are a direct reflection of the fire dynamics that caused them. For that reason, this Article deals with fire pattern analysis and fire dynamics analysis as a single source of information for area of origin determination.

34 NFPA 921, *supra* note 7, at 48.

35 *Id.* at 22–75.

rules of thumb, such as assuming that the deepest char, greatest amount of burn damage, or presence of a V-pattern indicates the area of origin, can be misleading.

A complicating factor in the determining the area of origin is a condition known as "flashover."[36] Flashover is a transient phase in an enclosed room fire where the temperature rises so high throughout the room that combustible items begin to burn, even at floor level and in areas away from the fire's origin. As a fire approaches flashover, the hot smoke layer which forms along the ceiling radiates heat downward towards the floor. Eventually, if the circumstances are right, any combustible items in the room exposed to the radiated heat from the hot smoke layer will ignite nearly simultaneously.[37]

Flashover conditions quickly transition to "full room involvement." This is the point in a fire's progression where ventilation-generated fire patterns can create conflicting burn damage and fire patterns throughout the room that can distort or mask the true area of origin.[38] Fire damage created by ventilation can be, and often is, deeper, lower and more pronounced than fire damage in the fire's area of origin, leading even experienced fire investigators to easily misidentify the fire's area of origin.

The burn patterns created in the early stages of fire development—those patterns likely to be in or near the fire's area of origin—may or may not persist through flashover and full room involvement. As well as creating new burn patterns throughout the compartment, full room involvement conditions often obscure or destroy the burn patterns in or near the area of origin which would have been observable had the fire been extinguished prior to flashover.[39]

---

36 *Id.* at 45.

37 *See generally id*. at 45–48 (a comprehensive discussion and explanation of flashover and full room involvement and their effects); *see also* STEVEN W. CARMAN, IMPROVING THE UNDERSTANDING OF POST-FLASHOVER FIRE BEHAVIOR [hereinafter IMPROVING THE UNDERSTANDING], https://www.nacdl.org/uploadedfiles/files/resource_center/topics/post_conviction/atf_sa_carman_post_flashover_fires_isfi_08.pdf ; STEVEN W. CARMAN, PROGRESSIVE BURN PATTERN DEVELOPMENT IN POST-FLASHOVER FIRES (2009) [hereinafter PROGRESSIVE BURN], http://carmanfireinvestigations.com/dl/(Carman&Associates)%20-%20Progressive%20Burn%20Pattern%20Development%20in%20Post-Flashover%20Fires.pdf; GREG GORBETT & RONALD HOPKINS, THE CURRENT KNOWLEDGE & TRAINING REGARDING BACKDRAFT, FLASHOVER, AND OTHER RAPID FIRE PROGRESSION PHENOMENA (2007), https://online.columbiasouthern.edu/CSU_Content/courses/Emergency_Services/BFS/BFS3251/11F/UnitIII_SupplementalReading_TheCurrentKnowledgeTraining.pdf; PATRICK M. KENNEDY & KATHRYN KENNEDY, FLASHOVER AND FIRE ANALYSIS: A DISCUSSION OF THE PRACTICAL USE OF FLASHOVER IN FIRE INVESTIGATION (2003), http://www.experts.com/content/articles/Patrick_Kennedy_Flashover_and_Fire_Analysis.pdf.

38 NFPA 921, *supra* note 7, at 45–48.

39 *Id.* at 53.

ii. Arc Mapping

NFPA 921 describes arc mapping as a "technique in which the investigator uses the identification of arc locations or 'sites' to aid in determining the area of fire origin."[40] Arc mapping is an interpretation of the spatial relationship of specific forensic artifacts on energized electrical conductors that were damaged by heat during the course of the fire. Those forensic artifacts are created when the heat of a fire causes an "arc"[41] in an electrical circuit. The location of these arc sites in relation to the building, the electrical system, and each other, combined with an understanding of the sequence in which they were created, has been used to support an area of origin determination.

Arc mapping relies on four fundamental principles: (1) "The predictable behavior of energized electrical circuits exposed to a spreading fire"; (2) the ability of the fire investigator to locate and identify all of the relevant arc sites; (3) the ability of the fire investigator to distinguish, through sight and touch, between the damage caused by an electrical arc and similar damage caused by localized melting of the conductor; and (4) the ability of the fire investigator to recognize and correctly interpret the locations and spatial relationship of the identified arc sites to inform an understanding of where the fire began.[42]

To date, no published research exists that measures the accuracy or error rate of any of these principles, much less a fire investigator's ability to bring these factors together to actually figure out where a fire started based on the arc mapping methodology.

Perhaps because of its unknown value in informing an area of origin conclusion, NFPA 921 does not describe arc mapping as a standalone methodology to determine where a fire began, advising instead that arc mapping "can be used in combination with other data to more clearly define the area of origin."[43]

iii. Witness Statements

The way in which the fire investigator approaches the use of witness information, and how a witness statement influences the investigator's final conclusions, remains a subject of some controversy in the fire investigation community. NFPA 921 supports the use of witness information as a legitimate

---

40 *Id.* at 196.

41 *Id.* (an electrical arc is "a high-temperature luminous electrical discharge across a gap or through a medium such as charred insulation").

42 *Id.* Also, for more information on the impact of ventilation on fire pattern development and fire pattern persistence, see generally FED. EMERGENCY MGMT. AGENCY, U.S. FIRE ADMIN., USFA FIRE BURN PATTERN TESTS: UNITED STATES FIRE ACADEMY PUBLICATION #FA-178 (Kennedy et al. eds., 1997).

43 NFPA 921, *supra* note 7, at 196.

source of data to be analyzed,[44] but provides conflicting information on just how a witness statement can and should be used by a fire investigator in forming an expert conclusion on where a fire began. It goes on to describe the utility of witness observations in determining the origin of the fire,[45] but cautions that "witness statements regarding the location of the origin create a need for the fire investigator to conduct as thorough an investigation as possible to collect data that can support or refute the witness statements."[46] Most importantly, if the "witness statements are not supported by the investigator's interpretation of the physical evidence, the investigator should evaluate each separately."[47] How NFPA 921 squares the imperfect and often unverifiable nature of a witness statement with its general reliance on empirical data remains unclear.[48]

Fire investigation is not the only forensic domain that grapples with the effects of witness statements on expert conclusions. Forensic pathologists trying to determine the cause and manner of death often find themselves confronting the same dilemma,[49] and their conclusions, like those of a fire investigator, often span the gap between opinions based on forensic and medical science and those based on circumstantial evidence. And like fire investigators, forensic pathologists often view themselves more as crime fighting detectives rather than objective forensic examiners.

The parallels between death scene and fire scene investigation go further still: In the same way that the origin and cause of a fire are determined through the application of scientific principles to an examination of fire scene evidence, the cause of death is primarily determined by applying the principles of science and medicine in an examination of the body, usually an autopsy or a laboratory test. In other words, determining the cause of death, like finding the origin and cause of a fire, is a forensic discipline which relies on an objective application of the scientific method. However, classifying the cause of death as accidental, natural, suicide, or homicide (like the classification of the cause of a fire as accidental, natural, or incendiary) is not a forensic or scientific conclusion, and not truly an expert opinion at all. Whereas the determination of cause of death is

---

44 *Id.* at 186.

45 *Id.* at 191 ("Such witnesses can provide knowledge of conditions prior to, during, and after the fire event. Witnesses may be able to provide photographs or videotapes of the scene before or during the fire. Observations are not necessary limited to visual observations. Sounds, smells, and perceptions of heat may shed light on the origin.").

46 *Id.*

47 *Id.*

48 *Id.* at 19.

49 *See generally Glossary*, HARRIS COUNTY INST. FORENSIC SCI., http://ifs.harriscountytx.gov/Pages/Glossary.aspx (last visited Nov. 3, 2016) ("Cause of Death is the disease or injury responsible for the lethal sequence of events . . . Manner of Death explains how the cause of death arose" and is a classification of the cause of death: Natural; Accident; Homicide; Suicide; or Undetermined).

reached through the expert application of scientific principles and medical knowledge to the examination of physical and empirical evidence through autopsy and laboratory evaluations, the classification of the cause of death (the manner of death) is found through a common sense evaluation of the totality of the circumstances, often including the statements of eyewitnesses.[50] The same issue regularly arises in fire investigation.

In more well established forensic domains, the issue of using witness statements to influence expert conclusions is more clear-cut. Imagine a DNA analyst being asked to examine a blood sample taken from a crime-scene and compare it to the genetic profiles of a suspect and a victim. For whatever reason, the results of the DNA analysis are somewhat inconclusive; the analyst is able to clearly identify the victim's blood in the sample, but unable to either include or exclude the suspect as the additional contributor. Now imagine that the police then explain to the analyst that they have a credible eyewitness who saw the entire incident and that because of that statement, the only possible donors to the blood sample evidence are the victim and the known suspect.

The question becomes, how should the analyst use this witness information in her evaluation of the evidence? In DNA analysis (and every other serious discipline of forensic science) the answer is clear. In fire investigation, it is not.

As explained above, NFPA 921 generally supports the use of witness statements as a technique for assisting in the area of origin determination,[51] and fire investigators routinely testify that their analysis of witness statements plays an important role in their investigations and conclusions.

But, this broad endorsement by NFPA 921 does little to assist the fire investigator in understanding when a witness's statement crosses the line between providing reliable data useful for developing an investigative hypothesis, and providing unverifiable information which often morphs, in the

---

[50] State v. Tyler, 867 N.W.2d 136 (Iowa 2015). The suspicious death of a newborn in 2011 provides an example. *See id.* When Baby Tyler's body, a piece of the umbilical cord, and the placenta were examined by a medical examiner from the State Medical Examiner's office, no clear cause of death was apparent. *Id.* at 148. After performing an autopsy and pathology examination, the medical examiner concluded that the cause and manner of the baby's death were "undetermined." *Id.*

However, in his final report, he attributed the cause of death to "[b]athtub drowning" and classified the cause of death as "[h]omicide." *Id.* His report said that he based his final conclusions on an external and internal examination of the body, as well as statements made by the baby's mother to the police. *Id.* His report stated, "The mother claimed she had given birth the previous day in the motel room and then placed the infant in a bathtub partially filled with water shortly after the birth." *Id.* At a hearing to suppress the medical examiner's testimony regarding the cause and manner of death, the pathologist conceded in response from questioning by defense counsel that he could not have determined cause and manner of death from the autopsy alone but did so on the bias of the mother's confession to the police. *Id.* at 150; *see id.* at 148–53.

[51] NFPA 921, *supra* note 7, at 186 ("The analysis of observations reported by persons who witnessed the fire or were aware of conditions present at the time of the fire.").

mind of the investigator, into the final conclusion. The guide contains no warnings regarding the potential introduction of domain-irrelevant and potentially biasing information that occurs when a witness interview goes beyond where the fire started and turns to who started it and why.

C. The Longer It Burns, the Greater the Opportunity for Error

As explained previously, the basic process of determining a fire's area of origin is to examine and interpret the very damage that the fire itself creates. In its earliest stage, the damage caused by a fire, at least at first, is isolated to where the fire began. If the fire is extinguished early in its development, determining its area of origin by interpreting fire patterns can be a fairly straightforward process. But, as a fire grows, the evidence it creates becomes more complex—fire patterns and burn damage begin to conflict, conflate, and compete with the earlier patterns, making interpretation more difficult and subjective. Common fire conditions, such as flashover, full room involvement, ceiling collapse, and overhaul,[52] produce extremely complex fire scenes.

The limited research in the field of area of origin determination suggests that when this type of complex fire scene is examined by several independent fire investigators, they will draw different conclusions. When the same forensic methodology (in this case fire -pattern analysis or arc mapping) is applied to the same piece of physical evidence (the fire-scene and the evidence it contains) and produces inconsistent expert conclusions, this is the very definition of an unreliable methodology.[53] That is not to say that the investigators are unreliable or untrustworthy, only that the methodologies being employed simply do not have the capacity to produce consistent and accurate results. Moreover, it signals the point in fire-scene examination when forensic expert opinions regarding the fire's area of origin begin to lose their value.

At various points in the lifespan of a fire, as fire-related evidence goes from clearly defined (as is the case with a fire that is limited in space and duration), to complex (which occurs when a fire expands to the point it destroys some evidence or introduces multiple theories of origin and causation), to completely destroyed (as is the case in a large fire that destroys all evidence), the efficacy and scientific foundation of fire pattern analysis is at first reliable, then

---

[52] *Id.* at 17 ("Overhaul: A firefighting term involving the process of final extinguishment after the main body of the fire has been knocked down. All traces of fire must be extinguished at this time.").

[53] Throughout this Article the words "reliability" and "validity" are used, as they are in forensic science generally, to mean consistency and accuracy; that is, a reliable methodology is one which has the capacity to return consistent and repeatable results, and validity means an accurate result which reflects the ground truth. For more on the subject of reliability and validity in forensic examinations (specifically in the field of fingerprint comparison) see generally Simon A. Cole, *Is Fingerprint Identification Valid? Rhetorics of Reliability in Fingerprint Proponents' Discourse*, 28 L. & POL'Y 109 (2006).

marginalized, and then completely lost. The question of when that point is reached, and how that point is recognized, remains unanswered in the fire investigation community.

By contrast, the field of fingerprint comparison has recognized that the underlying reliability of a fingerprint comparison is, to a large degree, a reflection of the quality of the latent print being evaluated. A review of the level of damage to the source evidence being examined has been built into that field's standard protocol. In fact, the crucial first step in evaluating an unknown (latent) fingerprint is to determine if it contains sufficient information to be used for a comparison. If the print is not suitable for comparison—due to damage, lack of clarity, or anything else that diminishes the quality or quantity of usable information contained in the print—the examination ends because there is insufficient information on which to base a reliable analysis.[54]

In this way, fingerprint examiners have at least made some attempt to overcome a fundamental concern in forensic science—what to do when the evidence being examined is damaged or degraded to such a degree that the methodologies of the domain no longer apply or lack the capacity to provide reliable results. When this condition occurs in a fingerprint comparison, the examination ends. When it occurs at a fire scene examination, the investigator presses on.

1. Reliability and Validity of Area of Origin Determination

The Supreme Court's decision in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,[55] assigned to the trial judge the role of "gatekeeper" in assessing the reliability of the principles and methods used by an expert witness proffering testimony under Rule 702 of the Federal Rules of Evidence.[56] Under *Daubert*, the trial judge is not attempting to measure the accuracy of the expert's conclusions, simply the reliability of the methodologies employed.[57] The Supreme Court developed a list of five factors to assist the trial judge in making

---

[54] U.S. DEP'T OF JUSTICE, THE FINGERPRINT SOURCEBOOK 9–13 (2011), https://www.ncjrs.gov/pdffiles1/nij/225320.pdf.

[55] 509 U.S. 579 (1993).

[56] Rule 702 allows a jury to hear expert testimony when the expert's opinions are based on scientific, technical, or other specialized knowledge that will help the jury to understand the evidence or to determine a fact in issue. *See* FED. R. EVID. 702. In order to qualify under Rule 702, the expert's testimony must be the product of reliable principles and methods, and those methods must have been reliably applied to the facts of the case. *Id.*

[57] NAT'L RES. COUNCIL, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD 96 (2009) [hereinafter NAS REPORT] (**"**[I]f one focuses solely on federal appellate decisions, the picture is not appealing to those who have preferred a more rigorous application of *Daubert*. Federal appellate courts have not with any consistency or clarity imposed standards ensuring the application of scientifically valid reasoning and reliable methodology in criminal cases involving *Daubert* questions.").

this preliminary assessment.[58] Included amongst these factors is the error rate for the methodology being used.

The National Academy of Sciences 2009 report, *Strengthening Forensic Science in the United States: A Path Forward*, also emphasizes the importance of understanding the rate of accuracy and error, and concludes that these are not known in many forensic domains.[59] The report provides two important insights in considering the weight to be given to scientific evidence and testimony:

> (1) the extent to which a particular forensic discipline is founded on a reliable scientific methodology that gives it the capacity to accurately analyze evidence and report findings and (2) the extent to which practitioners in a particular forensic discipline rely on human interpretation that could be tainted by error, the threat of bias, or the absence of sound operational procedures and robust performance standards.[60]

The NAS Report's caution against the threat of human error and bias in distorting scientific methodology is particularly relevant to fire investigation because fire pattern analysis is based almost entirely on human interpretation. Unlike some forensic domains that rely on objective quantification and scientific measurement, the analysis, importance, and underlying cause of a fire pattern or damage to a piece of fire debris, as well as a determination of how a fire developed based on those patterns and damage, is highly dependent on the subjective interpretation of the examiner. At a fire scene, the human examiner is the sole instrument of analysis.

The recent publication *Forensic Science in Criminal Court: Ensuring Scientific Validity of Feature-Comparison Methods*,[61] by the President's Council of Advisors on Science and Technology ("PCAST"), goes further still. The report recognizes that expert testimony in forensic disciplines that lack well-defined values of foundational reliability and where error rates are unknown is potentially misleading and of little to no value in informing a jury.[62]

Proficiency testing within the fire investigation community with performance data and criteria are yet to be developed. And, while NFPA 921

---

58 *Daubert*, 509 U.S. at 593–95 ((1) whether the theory of technique in question can be and has been tested; (2) whether it has been subjected to peer review and publication; (3) its known or potential error rate; (4) the existence and maintenance of standards controlling its operation; and (5) whether it has attracted widespread acceptance within a relevant scientific community).

59 NAS REPORT, *supra* note 57.

60 *Id*. at 9.

61 *See generally* EXEC. OFFICE OF THE PRESIDENT, PRESIDENT'S COUNCIL OF ADVISORS ON SCI. & TECH., REPORT TO THE PRESIDENT: FORENSIC SCIENCE IN CRIMINAL COURTS: ENSURING SCIENTIFIC VALIDITY OF FEATURE-COMPARISON MODELS (2016), https://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf.

62 *Id.*

attempts to provide a systematic process for determining a fire's origin by examining fire patterns and arc sites, the reliability and accuracy of these methodologies remain largely unknown.

The unreliability of current methodologies for determining fire origin was dramatically demonstrated in a live-fire exercise conducted by ATF in 2005, in which it found that the accuracy of fire investigators' determinations of the correct quadrant of origin in a room fire that had burned two minutes past the onset of flashover was less than 6%.[63] A similar set of exercises conducted at the Federal Law Enforcement Training Center had an accuracy rate that hovered between 8 and 10%.[64] In a follow-up exercise in 2007, three similarly constructed and furnished rooms were burned 30 seconds, 70 seconds, and 180 seconds past the onset of flashover and full room involvement. The accuracy of fire investigators in determining the correct quadrant of origin in these fires was 84%, 69%, and 25%, respectively.[65]

Follow-up review of these exercises showed that errors in determining the correct area of origin were largely attributable to fire investigators applying pre-flashover fire pattern analysis to a post-flashover fire scene that had experienced full room involvement conditions.[66]

Additional research has shown that during the full room involvement following flashover, ventilation patterns become the dominant factor in the creation of fire patterns, not the location of burning objects as is the case in a pre-flashover environment.[67] In other words, during flashover and full room involvement, fire patterns and the amount of burn damage on walls, ceilings, floors, and pieces of furniture will be primarily the result of air flow currents through the room and have absolutely no bearing on the area of origin of the fire. This research also showed that burn patterns near the area of origin created early in the fire's progression (prior to the onset of flashover) sometimes remained visible during and after the onset of flashover and sometimes did not.[68]

A broader and more rigorous study, involving over 600 fire investigators, provided some data on the accuracy of area of origin determination. This study revealed that approximately 75% of the participants were able to choose the correct general area of origin in a post-flashover fire.[69] For this study, a room was lightly furnished, allowed to burn only one minute

---

63 *See generally* IMPROVING THE UNDERSTANDING, *supra* note 37.

64 *Id*.

65 Lentini, *supra* note 2, at 18.

66 *See generally* PROGRESSIVE BURN, *supra* note 37.

67 *Id*.

68 *Id*.

69 *See generally* ANDREW T. TINSLEY & GREGORY E. GORBETT, FIRE INVESTIGATION ORIGIN DETERMINATION SURVEY (2013), http://fireandarsoninvestigation.eku.edu/sites/fireandarsoninvestigation.eku.edu/files/origin_survey_resubmission.pdf/.

past flashover, and care was taken not to disturb the fire scene during extinguishment and overhaul.[70] Even under these ideal circumstances, post-flashover area of origin determination had an error rate of approximately 25%.[71] This means that a quarter of the time investigators could be searching for a cause of the fire in the wrong location.

While there has been surprisingly little research to measure the reliability and validity of origin determination based on fire pattern analysis, corresponding research to measure the accuracy or error rate of arc-mapping in area of origin determination is even sparser. Indeed, it is completely non-existent. This is not to say that fire-pattern and arc-mapping analysis has no value, under some circumstances, as methods to identify a fire's area of origin. However, in the absence of any serious research to measure the reliability and validity of these techniques, their utility in assisting a fire investigator in establishing where a fire began—the single most important finding in conducting a forensic fire scene examination—is simply unknown.

What is clear from the studies and the ATF exercises described above is that the general reliability and accuracy of fire investigators determining the correct area of origin in a room fire that has burned beyond flashover by analyzing the remaining burn patterns, even under best case circumstances, cannot be established to the degree of certainty needed for courtroom testimony. Yet, this is exactly the type of testimony routinely accepted by state and federal courts across the country.

For a fire investigator to testify in court in compliance with NFPA 921 that a fire started in a particular location, or that a particular ignition source started it, he must believe only that his conclusion is *probably* correct—i.e., more likely than not.[72] The guide provides no reference point on which to base this certainty other than to say it should be greater than 50%.[73] In a forensic domain, effectively absent any known rates of accuracy or error, how that 51% certainty is recognized—like most of the processes of modern fire investigation—is completely in the hands (and the mind) of the individual investigator. Also of concern, NFPA 921 provides no instruction on the importance of informing a jury that expert conclusions in the field of fire investigation may rest on a level of certainty that barely breaks even.[74]

---

70 *Id*.

71 *Id*.

72 NFPA 921, *supra* note 7, at 21 (describes two levels of certainty to be used as thresholds for a fire investigator in holding and expressing an expert opinion, "Possible" and "Probable").

73 *Id.*

74 *See* People v. Pike, 2015 IL App (1st) (holding that the testimony of a DNA expert regarding a conclusion with a 50% probability statistic did not even meet the evidentiary threshold of relevance). The 50% threshold of certainty called for by NFPA 921 falls well below accepted probability statistics for other forensic disciplines.

When fire scene conditions move beyond "best case circumstances"—due to longer burn times, movement of contents during overhaul, or the additional damage and burning caused by ceiling or building collapse—the accuracy of determining where the fire first began diminishes even further. However, fire investigators routinely use these tools (fire pattern and fire dynamics analysis, arc-mapping, and witness statements) to determine where the fire first began even at the most destructive fires—even at fires where the room where the fire began has been completely gutted by fire or the entire building has burned to the ground and the first fire patterns created (those that might give a clue to where the fire actually began) have been destroyed.

D. Cause Determination: The Flawed Processes for Interpreting Evidence

Once a fire investigator narrows down the area where the fire began, the next step in the process is to search that area for a potential heat or ignition source. In practical terms, this means searching through the rubble and debris in and near the fire's area of origin for any possible heat or ignition sources that may have started the fire and then matching each potential source to an appropriate fuel found in the same location. Like origin determination, NFPA 921 demands that the fire investigator use the scientific method to determine a fire's cause.[75]

Identifying the cause of a fire involves first identifying and matching a "competent ignition source" with an appropriate "first fuel ignited." Then, a fire investigator must account for "the circumstances or agencies that brought the ignition source in contact with the first fuel."[76]

Narrowing down and separating which ignition source actually played a role in starting the fire from those ignition sources that were just coincidentally found nearby usually includes some application of the process of elimination.[77] The idea here is for the investigator to examine and exclude those ignition sources that did not start the fire, allowing the investigator to focus her attention on those remaining sources of ignition that cannot be eliminated.

Each remaining ignition source then forms the basis of a separate hypothesis. The investigator evaluates each competing hypothesis and searches for evidence to prove or disprove each one.[78] This involves evaluating each possible ignition source and each hypothesized ignition sequence for evidence that tends to support or refute it as a reasonable explanation for what caused the fire.[79]

---

75 NFPA 921, *supra* note 7, at 199.

76 *Id.*

77 *Id.* at 203.

78 *Id.* at 202.

79 *Id.*

How an investigator approaches this process of examination, evaluation, elimination, and inclusion is left entirely to the individual investigator. NFPA 921 provides little guidance on how to separate ignition sources between those that *did not* start the fire from those that *may have* started the fire, and finally to the more definitive category of one that *actually did* start the fire. Moreover, the level of certainty needed to form a final conclusion is surprisingly low.[80]

1. Reliability and Validity of Cause Determination

Even if we assume that all potential heat or ignition sources in the area of origin are found and identified, the investigator's ability to accurately distinguish the ignition source that *did* start the fire from those that *did not* is completely unknown. The investigator is left to his or her own devices as to how to approach examining any particular ignition source for evidence of failure, misuse, or misapplication that may have led to a fire. Specific forensic artifacts or evidence showing that a particular ignition source actually started a fire, rather than simply being damaged by the fire, are often not present, and when they are present, their interpretation is remarkably subjective.

To put it simply, very often the true ignition source of a fire is indistinguishable from any other potential ignition sources found nearby. As the amount of fire damage to the items increases, so does the difficulty in distinguishing between damage that was the result of the item causing the fire and damage resulting from the fire itself. Interpreting the subtle differences in appearance between an item that ignited a fire from an equally damaged item that was simply damaged by the fire (assuming any differences, subtle or otherwise, actually exist), and measuring an investigator's ability to accurately do so, is a field of forensic science that currently provides more questions than answers and is in desperate need of further research. But, these are the questions fire investigators are expected to answer on a regular basis, at nearly every fire scene.

Like area of origin determination, the ability of a fire investigator to accurately identify which ignition source did or did not cause a fire is completely unknown. The unwritten methodology for approaching this challenge is a series of deeply subjective judgment calls where the primary measuring tool employed is the mind of the investigator. And as the amount of damage to any given piece of evidence increases through exposure to the fire, so too does the level of subjectivity in interpreting its meaning. And like fire pattern analysis, there is no agreed upon threshold of damage beyond which a fire investigator is prevented from performing this critical assessment.

This is precisely the type of expert opinion that the NAS and the PSAT reports warn of—where an imprecise methodology combines with a high degree

[80] People v. Pike, 2015 IL App (1st).

of human interpretation and an unknown error rate to create a process poised to be derailed by bias and simple human error.

2. Cause Determination in a Misidentified Area of Origin

Whatever the issues and challenges surrounding the determination of a fire's cause, this does not begin to confront the problem encountered when the fire's area of origin is misidentified and the fire investigator finds himself searching for the ignition source in an entirely wrong location. Three competing issues arise during such a scenario: (1) finding the true ignition source will be impossible because it is not there; (2) other likely ignition sources (including the true ignition source) located outside of the misidentified area of origin will be immediately dismissed and prematurely excluded because they were not found in the precise area where the fire was believed to have begun; (3) and finding no evidence of a competent ignition source in the misidentified area of origin, the fire investigator is likely to imply an unwarranted level of suspicion to the incident—a suspicion not based on affirmative evidence but on a lack of evidence.

This circumstance and its downstream implications present one of the most serious controversies in modern fire investigation and a clear example of fire investigation's separation from more mainstream and well accepted forensic disciplines: the continued and common practice amongst fire investigators of basing expert opinions on the absence of evidence.

3. Negative Corpus

A fundamental component of determining a fire's cause is the application of the process of elimination.[81] The process of elimination demands that the fire investigator examine, consider, and challenge every reasonable hypothesis of how the fire may have begun. So in a search for an ignition source, the process of elimination actually involves the development and testing of alternate hypotheses of how the fire began and what ignition sources may have been involved.[82] As alternate hypotheses are considered and challenged, some possibilities withstand the challenge and others are eliminated. This process of elimination (including development, testing, disproving, and eliminating alternative hypotheses) is "an integral part of the scientific method,"[83] and is conducted at nearly every fire scene.

A serious problem arises when the process of elimination alone is used not just to eliminate other competing hypotheses, but also to prove a single remaining hypothesis in the absence of any evidence directly supporting the final

81 NFPA 921, *supra* note 7, at 202.

82 *Id.*

83 *Id.* at 203.

conclusion. This method is so common in fire investigation that a unique term of art has been developed to describe it: "Negative Corpus."[84]

The most commonly paired results of the Negative Corpus methodology are when a fire investigator concludes that a fire's ignition source was an "open flame," and that the fire's cause classification was, therefore, "incendiary." Here is how it works: A fire investigator determines, for instance, that a fire began in the northeast corner of the living room. A search of the northeast corner reveals no evidence of the ignition source that started the fire. Based on an absence of an ignition source commonly associated with an accidental fire (such as a heater, electric lamp, extension cord, cigarettes, or candles), the fire investigator, using the process of elimination, decides that the fire must have been ignited with a match or a lighter that was then removed from the scene. Fire investigators call such an unidentified source an "open flame."

In this example, the potential ignition sources (heater, lamp, cigarettes, candle, etc.) were all excluded because there was no evidence to support that any of them were involved. Then, based on the same complete lack of evidence—and applying the Negative Corpus methodology—the fire investigator concludes that the ignition source was, therefore, an "open flame." And to take the process one step further in the mind of the investigator, with all of the ignition sources commonly associated with an accidental fire excluded, and following the same Negative Corpus process, the fire is found, therefore, to have been intentionally set.

Recent editions of NFPA 921 have rejected Negative Corpus as a clear violation of the scientific method.[85] However, it continues to be widely employed by fire investigators and continues to provide an avenue for forensic experts to arrive at expert conclusions based wholly on a lack of evidence.

Fire investigators also base expert conclusions on an utter lack of physical evidence in other ways. Consider the case of Michael Bryant, convicted in 2002 of murder, arson, and burglary.[86]

At Bryant's trial, a private fire investigator brought in by local prosecutors to determine the fire's origin and cause testified that gasoline had

---

84 For a good discussion and clear analysis of Negative Corpus, see Russ v. Safeco Ins. Co. of America, No. 2:11CV195-KS-MTP, 2013 WL 1310501 (S.D. Miss. June 14, 2013).

85 NFPA 921, *supra* note 7, at 203 ("The process of determining the ignition source for a fire, by eliminating all ignition sources found, known, or believed to have been present in the area of origin, and then claiming such methodology is proof of an ignition source for which there is no supporting evidence of its existence, is referred to by some investigators as *negative corpus* . . . [Negative Corpus] is not consistent with the scientific method, is inappropriate, and should not be used because it generates untestable hypotheses, and may result in incorrect determinations of the ignition source and first fuel ignited. Any hypotheses formulated for the casual factors (e.g., first fuel, ignition source, and ignition sequence), must be based on the analysis of facts. Those facts are derived from evidence, observations, calculations, experiments, and the laws of science. Speculative information cannot be included in the analysis.").

86 Bryant v. State, 651 S.E.2d 718 (Ga. 2007).

been poured throughout the mobile home and ignited to cover up the evidence of the murder victim discovered in the bathroom.[87] But, although Bryant had a strong alibi—multiple witnesses had seen him at a movie and dinner with his wife, placing him miles from the trailer at the time of the fire—it would be of no use because the fire investigator claimed that a fire could be lit using a delayed ignition device.[88] Using such a device, the arsonist could pour the gasoline, set the device, and then leave the scene prior to the fire's ignition. The investigator claimed that such a delay device could be rigged to ignite the fire hours or even days later.[89]

The only problem with this theory was that there was no physical evidence of a delay device recovered at the fire scene. The fire investigator told the jury that a delay device could be constructed that would leave no evidence.[90] After examining and eliminating other ignition sources in the trailer, and finding no evidence of a delay device, the fire investigator concluded that the ignition source must have been a type of delay device that leaves no evidence.[91] Here, the lack of any evidence was all the evidence he needed.

4. The Use of Accelerant Detecting Canines

Searching a fire scene and finding evidence of an ignitable liquid in a suspicious location is an understandably large focus in the field of fire investigation. If a jury is convinced that traces of gasoline were found at the scene of the fire, the road to a guilty verdict for arson can be short and straight.

Gas chromatography/mass spectrometry ("GC/MS") provides the fire investigator with reliable and accurate laboratory confirmation of trace amounts of a wide range of ignitable liquids that might be found in a fire debris sample. But, at a large fire scene, the problem faced by the fire investigator is where to take the sample—in the charred remains of a house fire, where are the most likely places a liquid accelerant might be found, and where should a sample be taken?

In 1986, the Connecticut State Police and the ATF developed a pilot program to train dogs to search fire scenes for ignitable liquid residue. The first accelerant detection canine ("ADC") trained under the program was a Labrador Retriever trained to respond (or "alert") to 17 different odors of ignitable liquids

87 *Id.* at 722–23.

88 *See id.* at 723.

89 *See id.*

90 *See id.* at 726.

91 *See id.* at 726–27.

commonly used as accelerants.[92] Over time, the training program grew and there are now over 130 certified ADC teams in use around the country.[93]

As the program grew, so did the confidence shown by ADC handlers in their dogs' ability to search for and find extremely small amounts of ignitable liquids among the charred remains of a fire scene. Many ADC handlers will say with absolute confidence that their dogs' noses are more sensitive to the presence of ignitable liquids than GC/MS analysis and that their dogs are 100% accurate.[94]

When it comes to comparing the sensitivity of a well-trained ADC to that of modern GC/MS regarding the presence of ignitable liquid residue, the research results are mixed, and which technique is more sensitive is the subject of controversy. What is known is that they are both quite sensitive and can accurately detect even very small quantities of ignitable liquids.[95]

However, in a fire-scene examination, the sensitivity of the ADC is not the substantive issue. Far more important is the dog's ability to discriminate between the chemical compounds contained in the ignitable liquid that the dog is trained to detect, and very similar or identical chemical compounds contained

---

[92] *See History of Accelerant Detection Canines*, USFA, https://www.usfa.fema.gov/prevention/outreach/canine/history.html (last visited Nov. 3, 2016).

[93] According to the State Farm Arson Dog Training Program, as of February 1, 2016, there were 85 active and certified ADC teams trained through the State Farm Arson Dog Program working throughout the United States and Canada (80 in the United States; 5 in Canada), *Active Teams*, STATE FARM, http://arsondog.org/about/active-teams/ (last visited Nov. 3, 2016); and as of May 2015, there were an additional 50 teams trained by ATF, *Accelerant and Explosives Detection Canines*, BUREAU ALCOHOL, TOBACCO, FIREARMS & EXPLOSIVES, https://www.atf.gov/explosives/accelerant-and-explosives-detection-canines (last visited Nov. 3, 2016). There are an unknown number of privately trained teams.

[94] *See* Videotaped Deposition of Captain Fred Dean Andes at 37–38, 78, Sloan v. Farmers Ins. Co., CV 2009-033244, 2012 WL 6755780 (Ariz. Super. Dec. 10, 2012) (regarding 100% accuracy: "Q: So in every case—every situation where [ADC] Sadie has alerted to the presence of an accelerant, that accelerant is present, that's your testimony? A: That's my testimony. . .Q: Your-your-your belief is that the dog is 100 percent reliable? A: I believe when the dog alerts, the dog is smelling an accelerant. Q: So that the dog is 100 percent reliable when she alerts to the presence of an accelerant? A: I believe when the dog alerts there is an accelerant present. Q: And what's the basis of that belief? A: We were taught in Maine that the dog is always right, and through trial and error and experience, I have learned that to be true. And with my tremendous amount of training with the dog, I find that all to be true;" regarding ADC being more sensitive than the lab: "Q: How many times has [ADC] Sadie alerted to the presence of an accelerant that was later not confirmed by the crime lab? A: I don't know. Q: Do you keep those statistics? A: No. Q: Why not? A: I don't feel the need to. Q: Don't you think that's relevant to her reliability? A: No. Q: Why not? A: I believe she's far superior to what the labs can do. Q: Explain me-for me the basis of that belief that she's far superior than a machine in a crime lab. A: From my basic training in Maine we worked with chemists there who taught us that, gave us examples of that. My daily training with her, I realized that she can hit very minute amounts. My continued reading and knowledge on the subject gives information to lead to the same conclusion.") (transcript on file with authors).

[95] *See generally* Michael E. Kurz et al., *Evaluation of Canines for Accelerant Detection at Fire Scenes*, 39 J. FORENSIC SCI. 1528 (1994); Reta Tindall & Kevin Lothridge, *An Evaluation of 42 Accelerant Detection Canine Teams*, 40 J. FORENSIC SCI. 561 (1995).

in the pyrolysis products of ordinary household items that are released into the atmosphere when these items burn.[96] Of special concern are the pyrolysis products created and released by burned plastics, bedding, upholstered furniture, carpet, and carpet padding,[97] the chemical compounds commonly present in a house fire.

In other words, a well-trained ADC's highly sensitive nose can and does lead to a high level of accuracy in finding and alerting to specific ignitable liquids *when they are present*. But, an ADC's lack of discrimination commonly leads to false positives—that mimic, to the dog, an ignitable liquid—where the ADC alerts to chemical compounds contained in pyrolysis products even *when no ignitable liquid is present*.[98]

It is because of ADCs' concerning level of false positives (again, not as a result of their lack of sensitivity to chemicals, but rather due to their lack of discrimination or selectivity between chemicals) that every fire investigation and canine professional association involved in the training or use of ADCs demands laboratory verification of fire debris samples.

In 1994, IAAI released a position paper on the value of unconfirmed ADC alerts. While recognizing the efficiency of using well-trained ADCs to identify areas where the presence of an ignitable liquid is suspected, the position paper makes it clear that an unconfirmed ADC alert lacks the reliability necessary for an ADC alert to be of any value in a courtroom.[99]

This position was ratified by the National Fire Protection Association and added to NFPA 921 through an emergency amendment in 1996. This amendment specifically advised, "In order for the presence or absence of an ignitable liquid to be scientifically confirmed in a sample, that sample should be analyzed by a laboratory. Any canine alert not confirmed by laboratory analysis should not be considered validated."[100] Unfortunately, to this day, dog handler testimony regarding unconfirmed alerts of ADCs have often been admitted in court as evidence of the presence of an ignitable liquid.[101]

---

96 *See generally* Sheryl M. Katz & Charles R. Midkiff, *Unconfirmed Canine Accelerant Detection: A Reliability Issue in Court*, 43 J. FORENSIC SCI. 329 (1998).

97 *See generally*, Michael E. Kurz et al., *Effect of Background Interference on Accelerant Detection Canines*, 41 J. FORENSIC SCI. 868 (1996).

98 NFPA 921, *supra* note 7, at 178 ("Research has shown that canines have responded or have been alerted to pyrolysis products that are not produced by an ignitable liquid and have not always responded when an ignitable liquid accelerant was known to be present.").

99 Lentini, *supra* note 2, at 14; *see also* Carl Chasteen et al., *IAAJ Forensic Science Commission Position on the Use of Accelerant Detection Canine*, 40 J. FORENSIC SCI. 532, 533 (1995).

100 NFPA 921, *supra* note 7, at 178; *see also* JOHN D. DEHAAN, KIRK'S FIRE INVESTIGATION 543 (6th ed. 2007).

101 For a detailed discussion of the admissibility of unconfirmed ADC alert testimony, see generally United States v. Hildenbrandt, 207 F. App'x 50 (2d. Cir. 2006); Goldstein v. Allstate Ins. Co., No. 95 Civ. 8783, 1998 U.S. Dist. LEXIS 18288 (S.D.N.Y. 1998); Farm Bureau Mut. Ins. Co.

In a 2012 position statement, the Canine Accelerant Detection Association ("CADA"), the oldest and largest national professional organization involved in the training, handling, and use of ADCs in the United States, went further: "[O]ur position is that no Prosecutor, Attorney or ADC Handler should ever testify or encourage testimony that an ignitable liquid is present without confirmation through laboratory analysis."[102]

The information provided by an ACD may help direct an investigative strategy and may save the examiner valuable time in narrowing down areas to examine more closely. However, a dog alert is not, in the absence of confirming laboratory analysis, evidence of the presence of an ignitable liquid. It is at best a presumptive test requiring independent, objective, and scientific corroboration.

III. THE DANGER OF MIXING FORENSIC AND CRIMINAL INVESTIGATORY ROLES

The police officer was the first on the scene and approached the trailer from the backyard.[103] He could see the orange glow of flames in the bedroom window and smoke pumping out from the eaves of the roof above it.

Running around to the front of the trailer, he looked through the open front door. The smoke in the living room was still light, and he could see across the room to the fire burning in the bedroom. He walked across the front threshold and stood next to the couch a few feet inside the doorway. As the fire grew in the bedroom, smoke was getting thicker and hotter along the ceiling where he stood.

When flames began to roll out along the top of the bedroom doorway towards the living room where he stood, the officer backed out the same way he came in. He watched through the front door as the fire began to engulf the living room and kitchen. As smoke and flames rolled out the front doorway he had

v. Foote, 14 S.W.3d 512 (Ark. 2000); Reisch v. State, No. 426, 1992, 1993 Del. LEXIS 229 (Del. June 4, 1993); Carr v. State, 482 S.E.2d 314, 318 (Ga. 1997); People v. Acri, 662 N.E.2d 115, 117 (Ill. App. Ct. 1996); Yell v. Commonwealth, 242 S.W.3d 331 (Ky. 2007); State *ex rel.* E.K., 766 So. 2d 661 (La. Ct. App. 2000); Commonwealth v. Crouse, 855 N.E.2d 391 (Mass. 2006); People v. Jackson, No. 272776, 2008 Mich. App. LEXIS 958 (Mich. Ct. App. May 13, 2008); State v. Sharp, 928 A.2d 165, 172 (N.J. Super. Ct. 2006); Maier v. Allstate Ins. Co., 838 N.Y.S.2d 715 (App. Div. 2007); People v. Dix, 662 N.Y.S.2d 879 (App. Div. 1997); State v. Abner, No. 20661, 2006 WL 2522384 (Ohio Ct. App. 2006); State v. Webber, 716 A.2d 738 (R.I. 1998); Fitts v. State, 982 S.W.2d 175 (Tex. App. 1998); State v. Schoulz, 58 P.3d 879 (Utah Ct. App. 2002); Bruce L. Ottley, *Beyond the Crime Laboratory: The Admissibility of Unconfirmed Forensic Evidence in Arson Cases*, 36 NEW ENG. J. ON CRIME & CIV. CONFINEMENT 263 (2010) ("Several courts have admitted the testimony (usually offered in the form of expert testimony), or indicated that they would admit it, if the proper foundation were established.").

[102] *CADA's Position on "Testifying to Negative Samples,"* CANINE ACCELERANT DETECTION ASS'N [hereinafter *CADA's Position*], http://nebula.wsimg.com/5c16de813c273d37d880d6464cd9b29a?AccessKeyId=8AE85CC0449F8A1178AF&disposition=0&alloworigin=1 (last visited Nov. 3, 2016).

[103] Yell v. Commonwealth, 242 S.W.3d 331 (Ky. 2007).

exited just moments before, he radioed the police dispatcher and reported the trailer was now "fully involved."

The state fire marshal investigator arrived a few hours later. One of the first things he noticed was the deep, low burning on the floors of the living room, kitchen, and bedroom. Using a shovel to dig away the fire debris in each location, he found areas in each room where the fire had burned holes through the floor. The investigator knew of only one thing that would cause a hole to be burned through a floor—a liquid accelerant, like gasoline, being poured and ignited.

Soon the state fire marshal arrived to assist in the investigation. He examined the same holes and drew the same conclusions: holes burned through the floor were clear evidence of an ignitable liquid; three holes, each in different rooms, were clear evidence of arson. Wanting confirmation, they called for the arson dog.

The dog handler was also a fire investigator. He knew the meaning of low burning and holes burned through a floor. When he and his dog first examined the trailer, with the dog on a long lead, the dog showed no interest. Things changed once the dog was put on a short leash and directed to each of the suspicious areas. The dog eventually alerted near each of the holes.

Despite the police officer's eye-witness account of a bedroom fire growing to engulf the living room and kitchen, each fire investigator was convinced that this fire was the result of an ignitable liquid poured in multiple locations and intentionally lit. This fire was arson, and they knew who did it.

When laboratory testing of fire debris from each location where the dog alerted was negative for ignitable liquids, their confidence was not shaken. The fire investigators knew what caused those holes, and the dog handler knew that his dog was better than the laboratory. He had been taught throughout his training to "trust your dog," and that is exactly what he did.

Any forensic domain with methodologies as lacking in scientific rigor as the ones described in this Article is bound to produce questionable results, as the case above illustrates. But fire investigation is susceptible to a potentially even more pernicious danger, namely the mixing of forensic examination and criminal investigation where the role of the fire investigator goes beyond determining where and how a fire started to trying to prove who started it and why. For all of these reasons discussed in this Article, determining precisely where a fire started and what caused it can be a difficult (and sometimes impossible) task, yet an arson investigator's ability to sift through the debris of a fire to determine where and how the fire began is almost folkloric. Part of that folklore revolves around the imagery and romance of the arson investigator himself—equal parts cop, forensic scientist, detective, and general sleuth.

Many of the problems discussed in this Article are a reflection of this unique and concerning mixing of forensic examination with criminal investigation: the mixing of *fire investigation* with *arson investigation*. In the simplest terms, *fire investigation* is a forensic discipline while *arson investigation* is not.

Like any forensic discipline, fire investigation involves the application of scientific, engineering, and technical principles to the examination of physical and empirical evidence. For the fire investigator, that physical evidence is the fire scene itself and all of the items contained in it.

The purpose of a forensic fire investigation is to determine the origin, cause, and development of the fire,[104] not who started it or why.[105] Because the fire investigator's conclusions are based on education, experience, and the application of scientific methodologies (in other words, analysis not available to a jury member), the opinions derived from that examination and analysis are often the subject of expert testimony.[106]

Arson investigation, on the other hand, is a subset of criminal investigation where the investigator considers the totality of the circumstances (including, perhaps, the conclusions of forensic experts) to understand if a crime took place and, if it did, to gather evidence to prove each element, understand possible motives, and identify a criminal suspect. Although criminal investigators routinely testify to their observations, the opinions of the criminal investigator are generally *not* admissible as evidence as they do not involve a form of analysis that the jury cannot do for itself.[107]

A. Fire Investigators Should Not Testify to the Ultimate Issue of Criminal Culpability

Because the examination, interpretation, and analysis by the fire investigator is based on a level of knowledge, skill, experience, training, or education in applying the processes and methodologies of fire investigation—a knowledge and experience level not available to the average jury member—the conclusions of the fire investigator regarding the origin, cause, and development of a fire or explosion clearly fall within the scope of expert testimony.[108]

Whereas the expert's testimony regarding the origin, cause, and development of a fire is clearly the subject of expert testimony, the classification

---

104 NFPA, *supra* note 7, at 15.

105 *See* NAS REPORT, *supra* note 57, at 23 ("[F]orensic investigations should be independent of law enforcement efforts either to prosecute criminal suspects or even to determine whether a criminal act has indeed been committed.").

106 FED R. EVID. 702 (allowing a jury to hear expert testimony when the expert's opinions are based on "scientific, technical, or other specialized knowledge [that] will help the [jury] to understand the evidence or to determine a fact in issue." In order to qualify under Rule 702, the expert's testimony must be the product of reliable principles and methods, and those methods must have been reliably applied to the facts of the case.).

107 FED. R. EVID. 701 (allowing testimony from a lay witness in the form of an opinion when it is: "(a) rationally based on the witness's perception; (b) helpful to clearly understanding the witness's testimony or to determining a fact in issue; and (c) not based on scientific, technical, or other specialized knowledge within the scope of Rule 702").

108 *See* NPFA 921, *supra* note 7.

of that cause (whether or not the fire was intentionally lit) is not because such classification requires an analysis of whether the ignition sequence was intentional or accidental. This conclusion goes beyond where and how the fire began and turns to the intentional or accidental nature of an incident. Nevertheless, the fire investigator is often asked to categorize the incident into one of four classifications: natural, incendiary, accidental, or undetermined.[109]

NFPA 921 defines an incendiary fire as "a fire that is deliberately set with the intent to cause a fire to occur in an area where the fire should not be;"[110] whereas an accidental fire is one where "the proven cause does not involve an intentional human act to ignite or spread [the] fire."[111]A fire is correctly classified as undetermined "when the intent of the person's action cannot be determined or proven to an acceptable level of certainty."[112]

NFPA 921 draws no distinction between the scientific or technical nature of determining a fire's origin and cause (the basis of an *expert* opinion)[113] with the circumstantial nature of inferring human intent or lack thereof when classifying a fire as incendiary or accidental. As a result, fire investigators are routinely called upon to testify to the classification of a fire's cause with the authority of an expert witness, as if that classification were the product of forensic expert analysis.[114]

Imagine for a moment that we were discussing a different forensic domain: A fingerprint analyst is asked to provide expert testimony as to her conclusions after comparing an unknown, latent print from the trigger of a pistol to the known, rolled print of a criminal defendant. The expert testifies that based on her examination of both prints, she has found sufficient similarity to conclude, with the certainty appropriate to the domain, that they both came from the same individual—that they are a match. The examiner's qualifications and the reliability of the methodologies employed notwithstanding, this is a simple example of expert testimony well within the confines of fingerprint comparison and allowable under *Daubert*.

Now imagine the next question asked of the fingerprint examiner is this: "Knowing now that the fingerprint found on the pistol is that of the defendant, what was the defendant's state of mind when he touched his finger to the trigger?" Or put differently, "Did the defendant touch the trigger intentionally or accidentally?"

---

109 *Id.* at 204.

110 *Id.*

111 *Id.*

112 *Id.*

113 *See generally id.*

114 *See generally* BRIAN HENRY & ANDREW SMITH, FITTING A SQUARE PEG INTO A ROUND HOLE —FIRE CLASSIFICATION UNDER NFPA 921 (2016), https://www.dropbox.com/s/pwr1p7czj615jeb/ISFI2016Proceedings_FittingaSquarePeg_BHenry.pdf?dl=0.

As outrageous as this line of questioning appears, it is precisely what occurs every time a fire investigator is asked to testify to the intentional or accidental nature of a fire. But whereas a fingerprint examiner would quickly recognize that questions of intent fall outside of the subject matter of her domain and go well beyond her expertise as a forensic practitioner, fire investigators, asked to testify to a defendant's intent, generally do not. As a result, fire investigators routinely testify with conviction and authority to their interpretation of a suspect's mental state.

The difference between an accidental and incendiary fire is entirely the difference between the deliberation or intent of a "human act." For a fire investigator to testify in this manner is to usurp the role of the jury and to exceed the limits of the forensic domain of fire investigation—yet this is the type of testimony that is elicited and accepted by courts across the country on a regular basis.[115]

B. Cognitive Bias at Work

In a perfect world, the expert conclusions of a forensic practitioner would be formed in a vacuum—absent any outside influence, a neutral observer examining all of the relevant data, using well-calibrated instruments and confirmed techniques, leading to reliable and accurate conclusions. Fire-scene investigations are never conducted in such a world.

The reality of fire investigation involves the application of subjective methodologies at fire-scenes flooded with emotionally charged, often irrelevant, and potentially biasing information; evidence is considered and analyzed by an investigator who, at best, is caught in the cross-fire of an adversarial system, and, at worst, is a partisan player going to work to draw a predefined conclusion.

The core factors that promote exaggerated and misleading testimony by forensic experts are well known: a subjective process, exposure to irrelevant but potentially biasing information, and a lack of genuine independence from law enforcement. These are exactly the issues confronted by fire investigators and nearly every fire-scene.

Expert conclusions influenced by bias, whether in fire investigation or another forensic field, should not be confused with an intentional desire on the part of the expert to proffer false testimony. On the contrary, the victim of bias is often unaware of its influence. This creates a situation where the expert witness providing unreliable testimony is harboring a false certainty regarding the accuracy of her conclusions.

---

115 See Order Excluding Expert Testimony at 4, State v. Edwards, Case No. 27-CR-15-6336 (Minn. Cir. Ct. Mar. 29, 2016), where the court grants the defense motion to exclude the state's fire investigator expert testimony regarding his classification of the cause of the fire as "incendiary" and opinions regarding human intervention needed to start the fire, as this testimony would not assist the trier of fact and lacked foundational reliability. *See also* HENRY & SMITH, *supra* note 114, at 10.

This type of expert testimony, which is sincere but nevertheless incorrect, can be especially dangerous. In *The Vision in "Blind" Justice: Expert Perception, Judgment, and Visual Cognition in Forensic Pattern Recognition*,[116] Dror and Cole point out three special concerns regarding the influence of bias-based expert testimony:

> (1) Cognitive biases affect all examiners [in any forensic discipline]. (2) Erroneous judgments of forensic experts are all the more persuasive in the legal context because the examiners believe them themselves. . . . (3) Many individual examiners—and more worrisome, many forensic professional bodies (both in the U.S and in Europe)—have been reluctant and resistant to acknowledge, accept, and take proper action to counter these biases."[117]

1. Role Bias and Conformity Effect

Research has shown that adopting a specific role can impact an observer's perspective and that it has a direct impact on what information a person seeks and how that information is perceived and processed. In a study where one group of participants assumed the role of a home buyer and another group assumed the role of a burglar, the observations made by the groups starkly differed depending on the role the participant adopted.[118]

When a forensic examiner begins to embrace the role of a criminal investigator, the bias created from that change in perspective can shape his observations, analysis, and conclusions. The *NAS Report* strongly recommends that "forensic investigations should be independent of law enforcement efforts either to prosecute criminal suspects or even to determine whether a criminal act has indeed been committed."[119]

The potential for a forensic examiner to reach bias-based conclusions when interacting closely with criminal investigators is enormous. In addition to adopting the perspective of a criminal investigator, a close alliance with law enforcement can alter the type of information to which a forensic examiner is exposed.

The effects of role bias can be compounded when there is pressure on the examiner to be in conformity with other investigators or examiners or when

---

116 Itiel E. Dror & Simon A. Cole, *The Vision in "Blind" Justice: Expert Perception, Judgment, and Visual Cognition in Forensic Pattern Recognition*, 17 PSYCHONOMIC BULL. & REV. 161 (2010).

117 *Id.* at 162.

118 James W. Pichert & Richard C. Anderson, *Taking Different Perspectives on a Story*, 69 J. EDUC. PSYCHOL. 309 (1977), *reprinted in* UNIV. OF ILL. AT URBANA-CHAMPAIGN, CTR. FOR STUDY OF READING 9–11 (2007).

119 *See* NAS REPORT, *supra* note 57, at 23.

one examiner relies on the views of others in order to develop what should be an independent conclusion.

Fire investigators can be especially at risk of assuming the role of a criminal investigator—in many jurisdictions this policy is officially endorsed. In place of the independence of forensic examination recommended in the *NAS Report*, many public agencies have adopted the *Arson Task Force* model where fire department investigators are teamed up with investigators from the police and district attorney's office, sharing responsibilities for the criminal investigation, where the lines between fire scene examiner and criminal investigator are not just blurred but are obliterated.

NFPA 921 does little to separate the two vocations. In the chapter titled "Incendiary Fires," NPFA 921 provides a list of indicators that an investigator may use in drawing a conclusion that the fire has been deliberately ignited under circumstances in which the person knows the fire should not be ignited.[120] In addition to physical evidence relating to the origin and cause of the fire that may be found at the fire scene (incendiary devices, delay devices, indications of multiple fires, etc.), the chapter contains a list of non-fire indicators under the heading, "Potential Indicators Not Directly Related to Combustion." These factors (removal or replacement of contents, absence of personal items prior to the fire, evidence of other crimes, indications of financial stress, over-insurance, owners with fires at other properties, etc.) fall outside an origin and cause investigator's area of expertise but are well within a criminal investigator's responsibility. In this way, NFPA 921 seems to encourage the fire scene examiner to consider information that may be helpful in proving the elements of a crime but are entirely irrelevant to the determination of a fire's origin or cause.

In no other forensic discipline is the forensic examiner expected to determine if a crime has or has not occurred, or to examine evidence outside the examiner's area of expertise in order to identify a suspect, verify a suspect's opportunity to commit the crime, or develop a motive. Only fire investigation, particularly as practiced in the public sector, has embraced the merger of forensic examiner with criminal investigator, seemingly unaware of the pitfalls this potential bias creates.

2. Expectation and Confirmation Bias

Expectation bias is the tendency for experimenters to believe, certify, and express data that agree with their expectations for the outcome of an experiment, and to disbelieve, discard, or downgrade the corresponding weightings for data that appear to conflict with those expectations.[121] In other words, the observer's conclusions are contaminated with a pre-existing

---

120 *See* NFPA 921, *supra* note 7, at 237.

121 *Id.* at 20; Monwhea Jeng, *A Selected History of Expectation Bias in Physics*, 74 AM. J. PHYS. 578, 581–82 (2006).

expectation and perception, reducing the observer's objectivity, and laying the groundwork for selective attention to evidence.[122] In fire origin and cause investigation, as in other forensic disciplines, expectation bias is caused by the examiner harboring an expectation prior to examining the evidence. The key ingredient of expectation bias is exposure to information that is *domain-irrelevant*. As the name implies, *domain-irrelevant* information is data that may be relevant to the wider criminal investigation, which would include identifying a suspect, establishing a motive, and determining if a crime has even occurred. Such information, however, is not relevant to the forensic examination at hand—namely, determining the origin and cause of the fire.

A closely related phenomenon is confirmation bias, which is the tendency to search for or interpret information in a way that confirms the observer's preconceptions.[123] The hallmark of confirmation bias is the effort to bolster a hypothesis by seeking out evidence that supports the preconception, while dismissing contradictory evidence.

An important implication of expectation and confirmation bias is the influence it plays on the amount of information or evidence necessary to reach the minimum threshold needed to form a conclusion. In the presence of a pre-formed expectation, observers tend to require less evidence to support a conclusion consistent with their expectation.[124]

Cases and research involving fingerprint analysis provide particularly clear examples of the impact of expectation bias in forensic examinations. Fingerprint analysis, like fire pattern analysis, lacks clear instrumental measurement. In both types of examinations, the measuring instrument, in large part, is the examiner performing the analysis.[125] Reliance on human perception and interpretation of images and patterns, whether they be fingerprints, bite marks, tool marks, handwriting, or fire patterns, is both common and concerning because expectation bias is most potent where the underlying analysis is subjective, ambiguous, or ill-defined.

The erroneous fingerprint identification of Brandon Mayfield and the follow-up research based on his case exposed the effects of expectation bias and

---

122 For more information on expectation and perception, see ULRIC NEISSER, COGNITION AND REALITY: PRINCIPLES AND IMPLICATIONS OF COGNITIVE PSYCHOLOGY (Richard C. Atkinson et al. eds., 1976).

123 MARGARET E. OSWALD & STEFAN GROSJEAN, *Confirmation Bias*, *in* COGNITIVE ILLUSIONS: A HANDBOOK ON FALLACIES AND BIASES IN THINKING, JUDGMENT AND MEMORY 79–96 (2004); NFPA 921, *supra* note 7, at 20.

124 For more information on decision thresholds, see Victoria L. Phillips, Michael J. Saks & Joseph L. Peterson, *The Application of Signal Detection Theory to Decision-Making in Forensic Science*, 46 J. FORENSIC SCI. 294, 296 (2001).

125 SIMON A. COLE, SUSPECT IDENTITIES 203–05 (2001); Lyn Haber & Ralph Norman Haber, *Scientific Validation of Fingerprint Evidence Under Daubert*, 7 L. PROBABILITY & RISK 87 (2008); Jennifer L. Mnookin, *The Validity of Latent Fingerprint Identification: Confessions of a Fingerprinting Moderate*, 7 L. PROBABILITY & RISK 127 (2008).

the use of selective re-examination.[126] Brandon Mayfield was an Oregon attorney arrested by the FBI and held as a material witness in the Madrid terrorist bombing case in 2004. His arrest was based on a misidentified partial fingerprint found at the crime scene in Madrid. The FBI fingerprint examiner's conclusions were confirmed by at least two additional FBI examiners, as well as a fingerprint examiner hired by the defense. Two weeks after Mayfield's arrest, the Spanish National Police matched the fingerprint to an Algerian, Ouhnane Daoud. Mayfield was released, and the FBI made a rare public apology and provided a $2,000,000 settlement.

In 2006, the Mayfield case was used in a dynamic research study to measure the influence of expectation bias in the field of fingerprint analysis.[127] Five experienced latent print examiners were given a pair of prints which they were told were Mayfield's fingerprint and the latent print from the Madrid bombing crime scene. None of the fingerprint examiners had ever seen these prints, but all were aware of the well-publicized case. In this way, the five participants were provided with strong contextual clues that the prints, although visually similar, were not a match.

In fact, the examiners were each given a set of prints that they had, years earlier in real criminal cases, concluded were matches. Each examiner had before them two fingerprints that they had previously determined to have come from the same source; however, the expectation in the minds of the examiners was that the fingerprints, although very similar, were not a match.

The fingerprint examiners were asked to compare the prints and to ignore any additional contextual information (particularly, that the prints were from the Mayfield case and known not to be a match). Four of the five examiners contradicted their original conclusions; three changed their conclusions from "identification" to "exclusion" and one changed from "identification" to "inconclusive." Only one examiner maintained his original conclusion that the two prints came from the same individual.

A follow-up study using 48 pairs of fingerprints showed that expectation bias fostered by information such as "the suspect confessed to the crime" or "the suspect has an alibi" could influence examiners' conclusions in both directions, towards "individualization" (a match) or "exclusion" (concluding that the two prints did not come from the same source).[128]

In a fingerprint comparison, the only domain-relevant information is the actual fingerprint images being compared; the conclusions of the examiners should be based on that information alone. Additional contextual information, such as "the suspect confessed to the crime" or "the suspect has an alibi," is

---

126 *See generally* OFFICE OF INSPECTOR GEN., A REVIEW OF THE FBI'S HANDLING OF THE BRANDON MAYFIELD CASE (2006) (investigating the "misidentification, investigation, and detention of Mayfield").

127 *See* Dror & Cole, *supra* note 116, at 162.

128 *Id.* at 165.

outside the domain of the fingerprint examiner. Although important factors in the overall criminal investigation, this information is domain-irrelevant to the forensic examiner. The same can be said for fire investigation; the conclusions of the fire investigator should be based on the physical and empirical evidence at the fire scene, not the highly-charged and potentially biasing information involved in proving the crime of arson.

This is not to say that the expectation itself is not necessarily valid or reasonable. On the contrary, a perfectly valid and well-reasoned expectation can create the bias and be equally harmful. However, the role of the fire investigator, as a forensic examiner, is to draw expert conclusions within his discipline based solely on reliable, domain-relevant information.

Once a fire investigator has drawn an investigative conclusion—such as where a fire started (its area of origin) or under what circumstance it was ignited (arson or accident)—it is very easy, intentionally or not, to exploit the vague and imprecise nature of fire-scene examination to make observations that support the conclusion and equally easy to dismiss evidence to the contrary.

In research designed to measure the impact of confirmation bias in the field of criminal investigation, Barbara O'Brien and Phoebe Ellsworth asked participants to review and evaluate a file from a criminal case.[129] A portion of the group was asked to develop a hypothesis as to the suspect early in the case review while the other participants were not asked to specify a suspect. The study showed that the simple act of naming a suspect early in the case review process tended to develop a bias in the minds of the participants, which caused them to search for evidence thought to inculpate their named suspect, while tending to ignore or downplay equally exculpatory evidence.[130] Moreover, participants who named a suspect tended to interpret ambiguous evidence in a manner consistent with their earlier conclusion.[131] And if the pre-formed conclusion is sufficiently embedded in the mind of the examiner, even clear and precise scientific analysis may be insufficient to dislodge it.

When forensic anthropologists were asked to evaluate a set of skeletal remains in order to evaluate the sex, ethnic ancestry, and approximate age at time of death, the influence of outside information became clear. In the absence of extraneous information, using only the techniques of their forensic domain, 69% of the control group opined the skeletal remains were those of a female (31% determined male; 0% undetermined). One-hundred percent of the same control group determined the remains were those of a Caucasian.

---

129 *See* Phoebe C. Ellsworth & Barbara O'Brien, *Confirmation Bias in Criminal Investigations*, CORNELL U. (Nov. 17, 2010), http://www.cornell.edu/video/confirmation-bias-in-criminal-investigations.

130 *Id.*

131 *Id.*

What is clear from the conclusions of the control group is that for this particular set of skeletal remains, gender determination was more subjective and ambiguous than the determination of racial ancestry.

When the first of two treatment groups were told prior to their examination that DNA testing had already determined the skeleton was that an Asian female, the ambiguity surrounding gender identification evaporated. One hundred percent of the first treatment group were able to confirm the DNA analysis: the skeleton—in the eyes of the treatment group—was clearly a female.

But subjectivity cuts both ways. While a belief that DNA testing had already determined the skeleton was from a female pushed examiners towards a confirming conclusion consistent with that expectation, a belief that DNA had confirmed the skeleton was from a male did the same thing but in the opposite direction. Only 29% of the second treatment group—who were told that DNA had determined the skeleton to be of a male—concluded the skeleton was female while 71% determined it was a male.

Even the more straightforward determination of racial identity became hijacked when the treatment groups were given contextual information before the examination took place. The treatment group that was told the remains were from a Caucasian completely agreed: 100% of the second treatment group, like the control group, concluded the skeleton was that of a Caucasian. However, when the other treatment group was told the skeleton was of an Asian, the power of expectation bias took over: the conclusion that the skeleton was Caucasian dropped from 100% to 50%.

	Control Group	Treatment Group 1: Female-Asian Context	Treatment Group 2: Male-Caucasian Context
Male	31%	0%	71%
Female	69%	100%	29%
Caucasian	100%	50%	100%
Asian	0%	29% (21% undetermined)	0%

The influence of domain-irrelevant and expectation inducing information is not limited to the examination of fingerprints or skeletal remains.[132] Research has shown that under the right circumstances, even the strong scientific underpinnings of DNA analysis can take a backseat to bias.[133]

Even though fire scene examinations pose special risks of exposing the investigator to potentially biasing information, the fire investigation community is largely unaware of its impact. Current fire investigation training curricula give

---

[132] Jose Kerstholt et al., *Does Suggestive Information Cause a Confirmation Bias in Bullet Comparisons?*, 198 FORENSIC SCI. INT'L 138 (2010).

[133] Itiel E. Dror & Greg Hampikian, *Subjectivity and Bias in Forensic DNA Mixture Interpretation*, 51 SCI. & JUST. 204 (2011).

short shrift to the subject of cognitive bias or its consequences. Although NFPA 921 mentions both expectation and confirmation bias and warns the investigator to avoid presumption, nothing is said to assist the investigator in recognizing the factors that contribute to the bias or the safeguards designed to prevent it.[134]

3. Selective Re-examination Bias

Perhaps the most elusive bias commonly found in forensic science is the use of selective re-examination to confirm a hypothesis or a conclusion, where the second, independent examination is conducted by an examiner who is (1) aware of the conclusion drawn by the original examiner, (2) often made aware of the same domain-irrelevant information that tended to bias the original examination in the first place, and (3) is on the receiving end of a direct or indirect implication as to the conclusion(s) he is expected to reach.

The use of selective re-examination, and the potential biases which it infers, is common in the field of fire investigation, where the secondary examiner is routinely told the conclusions of the first examination—where the fire is believed to have begun and the circumstances behind it—before the second, separate examination is conducted.

To find a clear example of selective re-examination combining with expectation and confirmation bias at a fire scene, we do not have to look beyond a dog handler testifying to an alert of an ADC.

ADC handlers and their dogs are often called to fire scenes to confirm the presence of an ignitable liquid that may have been used to accelerate the development of a fire. Often, the dog handler is given information about what is known, or thought to be known, about the case that has nothing to do with the search for an ignitable liquid.

In one Wisconsin case,[135] before examining the scene with his ADC, the dog handler "learned that three children had died, and that a woman who had been 17 weeks pregnant was in intensive care but not expected to live, but who also had lost her unborn fetus due to the injuries sustained."[136] The handler was "advised they believed that the fire was started with an accelerant (gasoline) by the suspect [sic] in custody statements."[137] So before entering the building with his dog, the handler already knew the magnitude of the case (multiple deaths and injuries), that a suspect had been arrested, and that the suspect had confessed to using gasoline.

With that expectation firmly planted in the mind of the dog handler, the results were not surprising. The dog allegedly alerted to multiple locations

134 NFPA 921, *supra* note 7, at 20.

135 *See* Criminal Complaint, Wisconsin v. Wand (Wis. Cir. Ct. Sept. 11, 2012) (Nos. 12-CF-074, 12-CF-075); Country Club Hills Police Report, Incident # 12-04962 (on file with authors).

136 *Id.*

137 *Id.*

throughout the building. While searching a badly burned bedroom, the dog handler recognized what he evaluated as suspicious fire patterns and determined that there "*[a]ppeared to have a secondary fire origins with what appeared to be 'pour patterns' on the floor at the foot of a . . . bed.*" The canine alerted to the bed in the area of the "*pour patterns*," confirming the handler's suspicions.

All of the samples taken from the fire scene and sent to the crime lab came back negative for presence of ignitable liquid. The negative lab results raise some disturbing questions: Were the unconfirmed alerts of the ADC the result of the dog's nose being more sensitive than the lab or just another example of the significant rate of false-positive alerts of ADCs searching a fire scene? Moreover, did the pre-formed expectations of the dog handler have any influence on the dog's behavior or on the handler's interpretation of the dog's behavior? A recent research study suggests it did.

In 2009, three researchers from the University of California at Davis designed a study to measure the influence of a dog handler's beliefs on the accuracy and reliability of dog scent alerts.[138] For their study, four rooms were used: one room had a piece of red construction paper on the outside of a cabinet, one room had a hidden decoy (piece of food and tennis ball), another room had the same hidden decoy with its location marked by a piece of red construction paper, and the final room had neither a hidden decoy nor red construction paper.[139] Eighteen dog handlers were told that the two rooms marked by a piece of red construction paper contained hidden target scent (participating canines were trained on explosives material, narcotics, or both).[140]

In truth, none of the rooms contained any target materials. As a result, any handler-reported dog alert to any location was a false-positive.

The study found that handlers reported alerts in all four rooms, with significantly more alerts reported at the locations marked by red construction paper.[141] The conclusions of the researchers were that the beliefs of the dog handlers had a significant impact on alert locations reported by handlers, and whatever the underlying sensitivity of the scent detection canines, a pre-formed belief on the part of the handler as to the location of the target material(s) tended to undermine the reliability of the dogs' alerts by increasing the rate of false-positive alerts as reported by handlers.[142]

---

138 *See* Lisa Lit et al., *Handler Beliefs Affect Scent Detection Dog Outcomes*, 14 ANIMAL COGNITION 387, 387 (2011).

139 *Id.* at 389.

140 *Id*. at 387.

141 *Id*. at 390–91.

142 *Id*. at 391–93.

IV. INNOCENCE CLAIMS DURING POST-CONVICTION REMEDIES

Just as a chain is only as strong as its weakest link, conclusions in forensic science are only as valuable—and reliable—as its weakest process. In the field of fire investigation, where final conclusions are built upon several underlying key sub-conclusions, the expert opinions of a fire investigator as to where or how a fire began are only as strong as the sub-conclusions that support them. In a forensic discipline with no internal mechanism to limit the conditions under which its core methodologies are applied, where an unverified statement of a witness can be translated by the investigator into a final conclusion, where opinions are often based on a complete lack of physical evidence, and where the investigator is routinely called upon to testify to matters entirely outside his or her expertise, it comes as no surprise that fire investigation remains an outlier among more highly regarded domains of forensic science.

Perhaps the only factor more concerning than its lack of scientific underpinning and entirely unknown error rates is the routine and consistent exposure to domain-irrelevant and potentially biasing information that has become a standard part of modern fire investigation. If the research in this area has taught us anything it is that the easiest way to corrupt a forensic science examination is to simply tell the examiner the answer before he or she is asked the question. Whether it is forensic anthropology, fingerprint comparison, or fire investigation, nothing hijacks the process more quickly than the examiner believing he knows the outcome before examining the evidence.

In the simultaneous and conflated process of fire and arson investigation, where the same investigator identifies a suspect, establishes an origin, investigates a motive, and determines a cause, it is an undeniable street-level reality that fire investigators often think they know the answers to these questions before he ever steps foot on the fire scene.

It is equally undeniable that, given its lack of scientific underpinning and routine biasing information, modern fire investigation poses a unique and substantial risk of increasing convictions of innocent individuals. As we discuss below, the risk of incarcerating innocent individuals is magnified when a criminal judicial system favors comity and finality to the point it is virtually impossible for defendants to obtain relief from their convictions—even when their convictions were based on investigative methods below rudimentary scientific standards.

A. The Relative Weightlessness of Innocence on Direct Appeal, in Habeas Proceedings, and in Innocence Protection Litigation

Inertia is built into the criminal justice system quite deliberately. Indeed, notions of comity and finality—that jurisdictions will recognize the validity and effect of judicial decisions, and that legal proceedings must come to an end—create a systemic intransigence that perpetuates an equity error—first made

during trial proceedings—through post-conviction remedy proceedings.[143] These concepts may have been necessary when the only evidence available was eyewitness testimony (which grows less accurate and more dim over time), but should arguably carry less weight now that "[a] rapid escalation in the quality and quantity of scientific evidence, including new tools and modes of analysis, has meant that for the first time in history some forms of evidence can become more reliable with time."[144]

The inertia of the criminal justice system dictates that, through every process of review after a conviction, the facts will be viewed in the light most favorable to the government,[145] that any trial errors must overcome the presumption of harmlessness,[146] that any constitutional errors will require a showing of prejudice,[147] and that anyone claiming innocence has a heavy burden of proof.[148] In short, our system amounts to one in which zero weight is given to defense evidence at appeal, plus zero opportunity for discovery, zero consideration of how errors would have affected the jury, and zero credit for any but the most compelling of new evidence equals, for most individuals challenging their convictions, zero relief.[149]

As we show below, the process of direct appeal is ill-equipped to deal with new evidence or claims of innocence, leaving essentially two potential mechanisms for litigating innocence claims: writs of habeas corpus in state[150]

---

143 *See* Keith A. Findley, *Innocence Protection in the Appellate Process*, 93 MARQ. L. REV. 591, 602 (2009) [hereinafter Findley, *Innocence*].

144 Robert J. Smith, *Recalibrating Constitutional Innocence Protection*, 87 WASH. L. REV. 139, 142 (2012).

145 *See* Brandon L. Garrett, *Judging Innocence*, 108 COLUM. L. REV. 55, 112 (2008).

146 *Id.* at 107–08.

147 *See, e.g.*, Strickland v. Washington, 466 U.S. 668 (1984) (ineffective assistance of counsel claims must demonstrate prejudice); Brady v. Maryland, 373 U.S. 83 (1963) (undisclosed exculpatory evidence must be material).

148 *See* Garrett, *supra* note 145, at 112–13 (45% of innocent defendants raised sufficiency of evidence claims on appeal, but only one was granted relief; the five in Garrett's study who raised factual innocence claims on federal habeas all had them denied).

149 *See, e.g.*, *id.*; Keith A. Findley, *Defining Innocence*, 74 ALA. L. REV. 1157 (2010) [hereinafter Findley, *Defining*]; Findley, *Innocence*, *supra* note 143.

150 We will not discuss state habeas because the issues are too varied and complex for the scope of this Article, and not necessary to the understanding that obtaining habeas relief based on any kind of innocence claims is difficult and rare. It is worth noting, however, that in theory, obtaining habeas relief in state court based on a freestanding claim of actual innocence ought to be easier than obtaining relief in federal court for a state conviction, since issues of federalism—of a federal court overturning a state conviction on factual issues—are absent. *See, e.g.*, Findley, *Defining*, *supra* note 149, at 1204.

and federal courts[151] and state statutes that grant prisoners a right to seek relief based on newly discovered evidence.[152]

1. The Direct Appeals Process Does Not Catch and Correct Factual Error

Brandon Garrett analyzed the first 200 DNA exonerations—cases in which there is no question, based on scientific proof, that the individuals convicted were innocent of the crime—and noted that only 14% of the cases resulted in a reversal, despite the fact that 133 of the 200 exoneration cases produced appellate opinions.[153] When capital cases are removed and only non-capital cases with appellate opinions considered, the percentage drops down to 9%.[154] These appellate courts did not recognize the innocence of the individuals who were seeking legal review of their cases; they failed, because of the system's focus on finality, to correct the ultimate legal error and the ultimate due process error of convicting an innocent person. We know this because the appellate courts' reversal rate for cases in which the appellant was innocent is virtually identical to the reversal rate of criminal appellants generally.[155] In other words, being innocent on appeal made no difference. In only 8 of the 133 cases with written opinions did judges suggest the appellants might be innocent; in contrast, in 43 of those 133 cases, or 32%, the judges found that there was error, but that the error was harmless.[156] Even more damning is that the system requires an appellant to demonstrate that acknowledged errors at trial, such as withheld exculpatory evidence under *Brady v. Maryland*,[157] ineffective assistance of counsel, and inappropriate inclusion or exclusion of experts, are not harmless.[158] This study found harmless error in 32% of the 133 innocence cases with appellate

151 A state prisoner may seek collateral review from federal courts for violations of the federal Constitution under 28 U.S.C. § 2254 (2012). A federal prisoner may seek collateral review under 28 U.S.C. § 2255 (2012).

152 *See infra* text accompanying notes 160–240.

153 Garrett, *supra* note 145, at 68.

154 Findley, *Innocence*, *supra* note 143, at 594; Garrett, *supra* note 145, at 61.

155 Findley, *Innocence*, *supra* note 143, at 594; Garrett, *supra* note 145, at 61.

156 Findley, *Innocence*, *supra* note 143, at 595–96; Garrett, *supra* note 145, at 107.

157 373 U.S. 83 (1963).

158 *See* Findley, *Defining*, *supra* note 149, at 1196 (The legal doctrine of harmless error holds that a reviewing court may find legal error at trial, but still uphold the conviction because the error was "harmless," meaning, it does not warrant a new trial. In short, rather than analyze whether the complained of error actually contributed to the jury's verdict, "courts broadly search the record by asking whether independent evidence of guilt taken alone could support the conviction." Professor Findley astutely points out that the doctrine of harmless error permits cognitive biases that "can contribute in powerful ways to a conclusion that the defendant was indeed guilty, and that the error was therefore harmless.").

opinions—as compared to only 26% of the matched comparison group of criminal appellate cases.[159]

Even constitutional errors as fundamental as those affecting the right to counsel require a showing that the trial was adversely affected: a defendant claiming his attorney was ineffective, in violation of his Sixth Amendment right to counsel, because he failed to investigate an alibi defense or other exculpatory information must prove that the attorney's representation fell below an objective standard of reasonableness and that the defendant was prejudiced because there is a reasonable probability that the result at trial would have been different had the attorney's performance not fallen below that standard.[160] Eighty-nine percent of the 200 innocence claims that denied relief on ineffective assistance of counsel claims were rejected "at least in part upon a finding that the defendant could not prove prejudice."[161] Meaning, they could not prove that the results of the trial would probably have been different.

The most direct way to assert innocence on appeal is to claim insufficient evidence, but it is nearly impossible to obtain a reversal on these grounds because the evidence is weighed in the light most favorable to the conviction—meaning, deferential to the facts established by the state at trial. As Keith Findley points out, "[d]eferential fact review by design makes it difficult for an innocent defendant to prevail on a claim of innocence on appeal."[162] And worse, this standard has become even more deferential over time: "Most courts [apply] the standard so deferentially that . . . they uphold convictions unless there is essentially no evidence supporting an element of the crime."[163] Case in point: 45% of the 200 innocent defendants raised insufficiency of the evidence claims, but only one obtained relief on that basis.[164]

Thus, it is left to courts in collateral proceedings, governors in clemency requests, and others involved in newly discovered evidence statute proceedings to correct factual errors and constitutional rights violations that implicate the fundamental fairness of a trial.[165]

---

159 Findley, *Innocence*, *supra* note 143, at 596; Garrett, *supra* note 145, at 109.

160 Strickland v. Washington, 466 U.S. 668, 669–70 (1984).

161 Findley, *Innocence*, *supra* note 143, at 604.

162 *Id.* at 603.

163 *Id.* at 602.

164 *Id.* at 602; Garrett, *supra* note 145, at 112.

165 We will refer to the statutes which permit introduction of newly discovered evidence in support of a claim of factual innocence as "innocence protection" (or "actual innocence") statutes because they are based on newly developed facts and not claims related to the violation of constitutional rights or trial error. These statutes provide a basis to attack a conviction directly, rather than collaterally by challenging the fairness of the trial process.

2. The Habeas Process Is Currently Equally Ineffective in Rooting Out Factual Errors

State and federal habeas corpus procedures are collateral attacks on convictions designed to correct constitutional errors, such as the government's suppression of exculpatory evidence in violation of state and federal due process rights.

As petitions for writs of habeas corpus seeking federal review of state convictions increased in the 1960s and 1970s,[166] the courts and Congress created several procedural obstacles for petitioners. The passage of the Anti-Terrorism and Effective Death Penalty Act in 1996, for example, dramatically reduced the availability of relief through federal review by requiring federal courts to give deference to state court decisions on the merits and factual findings of a case. Recent Supreme Court decisions, such as *Cullen v. Pinholster*,[167] further restrict a federal court's ability to conduct an evidentiary hearing.[168] In *Pinholster*, the Supreme Court held that federal habeas review "is limited to the record that was before the state court that adjudicated the claim on the merits."[169] *Pinholster* thus limits the ability of federal courts to conduct evidentiary hearings for state habeas petitions sought because "[i]f a claim has been adjudicated on the merits by a state court, a federal habeas petitioner must overcome the limitation of § 2254(d)(1) on the record that was before that state court."[170] In the wake of *Pinholster*, even evidentiary hearings that were conducted before the Supreme Court decision—and presented new facts that were not heard in state court—were ignored.[171]

---

166 Smith, *supra* note 144, at 170.

167 563 U.S. 170 (2011).

168 *Id.* at 171, 180–81 (The Court relied on its precedent and looked to the "backward-looking" language in the statute, which "focuses on what a state court knew and did." Justice Clarence Thomas, writing for the majority, opined, "[i]t would be strange to ask federal courts to analyze whether a state court's adjudication resulted in a decision that unreasonably applied federal law to facts not before the state court."); *see also id.* at 184–85 (The Court also explained that its holding does not make § 2254(e) superfluous because that provision, which limits the discretion of federal courts in considering new evidence taken at an evidentiary hearing, will still govern when the federal courts can consider new evidence in connection with claims that were not adjudicated on the merits in state court.).

169 *Id.* at 180.

170 *Id.* at 184.

171 *See, e.g.*, Williams v. Stanley, 581 F. App'x 295, 296 (4th Cir. 2014) (per curiam) (holding that because the state court adjudicated petitioner's habeas petition on the merits, petitioner "is not entitled to adduce evidence to support a claim under § 2254(d)(1)"); Spates v. Clarke, 547 F. App'x 289, 295 n.5 (4th Cir. 2013) ("The district court's *sua sponte* decision to reach for evidence not submitted to it or to the last state court that considered the matter . . . seems at least inconsistent with the spirit of *Cullen* . . . . In the end, however, it is unnecessary for us to resolve this dispute . . . ."); Elmore v. Ozmint, 661 F.3d 783, 851–52 (4th Cir. 2011) ("[W]e assume that *Cullen v. Pinholster* precludes our consideration of evidence developed subsequent to the [state

Evidence of innocence can help to overcome these procedural hurdles and is the only mechanism around draconian procedural bars. When a petitioner has procedurally defaulted, meaning, failed to raise a claim to the state or federal court within the statute of limitations, under federal habeas she or he can use a claim of innocence as a means to excuse that procedural default and have his or her underlying claims heard.[172] A petitioner may seek to demonstrate actual innocence under *Schlup v. Delo*,[173] which held that a petitioner demonstrates actual innocence when "it is more likely than not that no reasonable juror would have convicted . . . in the light of the new evidence."[174] In *House v. Bell*,[175] the Court held that Mr. House had satisfied this standard when DNA evidence proved that the semen on the murder victim's nightdress did not belong to House (though there had been some non-scientific evidence that implicated House).[176]

While evidence of actual innocence can help a petitioner get through the procedural quagmire, once those hurdles are scaled, a petitioner must still prove an underlying constitutional violation, such as described above.[177] Innocence alone is not enough; a petitioner must prove by a preponderance of the evidence that no reasonable juror would have convicted the petitioner in light of the new evidence.[178] Indeed, freestanding innocence claims in federal court for federal and state prisoners is, currently, only theoretical.[179] In other words, whether or not imprisonment of an innocent violates the U.S. Constitution absent some underlying constitutional violation at trial remains an open question: the Supreme Court has passed on several opportunities to decide whether or not a standalone innocence claim is cognizable in federal habeas.[180] While analysis of the U.S. Supreme Court's jurisprudence in this matter is beyond the scope of this Article, the direction of the Court's jurisprudence does not impart faith that the Court will rule on this issue any time soon, or, for that matter, in favor of those seeking relief. In *Herrera v. Collins*,[181] the Supreme Court assumed without

adjudication]."); Jackson v. Kelly, 650 F.3d 477, 480 (4th Cir. 2011) (holding that the district court's pre-*Pinholster* evidentiary hearing under § 2254(d)(1) should now be ignored in light of the Court's holding in *Pinholster* and its review be limited to what is in the state court record).

172 *See* House v. Bell, 547 U.S. 518, 522 (2006); Schlup v. Delo, 513 U.S. 298, 316 (1995).

173 513 U.S. at 326–27.

174 *Id.* at 327.

175 547 U.S. 518 (2006).

176 *Id.* at 541. Further analysis of how innocence is relevant to current federal habeas litigation and how innocence came to play the prominent role it enjoys is beyond the scope of this Article, though important to the issue of the future of litigating innocence claims.

177 *See supra* Part IV.A.1.

178 *See House*, 547 U.S. at 556 (Roberts, J., dissenting).

179 *See generally* Dist. Atty's Office for the Third Judicial Dist. v. Osborne, 557 U.S. 52 (2009); Herrera v. Collins, 506 U.S. 390 (1993).

180 *See generally Osborne*, 557 U.S. 52; *House*, 547 U.S. 518; *Herrera*, 506 U.S. 390.

181 506 U.S. 390 (1993).

deciding that "a truly persuasive demonstration of 'actual innocence'" made after trial would render the execution of a defendant unconstitutional, and warrant federal habeas relief, but the majority opinion emphasized that habeas proceedings are not designed to evaluate facts.[182]

Even if a freestanding innocence claim were available, the showing needed would be so exceedingly extraordinary it is difficult to imagine any but the most clear-cut DNA case—if that—satisfying the standard. Indeed, one court has described this burden of proof as an impossibly high standard of proof:

> By that I do not mean that as a practical matter precious few applicants will be able to produce new evidence sufficiently compelling to meet the *Herrera* majority's test. By that I mean that it will be impossible by definition for any applicant to meet the test, regardless of how compelling his newly discovered evidence.[183]

This impossible standard is likely due in part to an aversion to second guessing factual matters determined by the state,[184] a core principle of comity.[185] But another reason, articulated by Justice Sandra Day O'Connor's *Herrera* concurrence, is that "[o]ur society has a high degree of confidence in its criminal

---

[182] *See generally Herrera*, 506 U.S. at 393; *see also Osborne*, 557 U.S. at 67–70 (providing a ray of hope, in that the U.S. Supreme Court assumed something there it had never before assumed: that a free standing innocence claim might be available even to a non-capital defendant); *House*, 547 U.S. at 555 (reversing a Sixth Circuit decision denying House review of his constitutional claims because he did not meet the stringent standard of *Schlup*; the Court reversed, stating that, though the *Schlup* standard is exacting, House's new DNA evidence excluding him from sperm on the decedent's nightgown (which the prosecution had argued at trial belonged to House, and that rape was the motive of killing the victim) was so extraordinary that it could be granted review despite his failure to present the new evidence in state court. While the Court recognized the evidence as powerful, it declined to discuss the standard for any hypothetical innocence claim under *Herrera*, noting that House barely met the *Schlup* standard—a result that is rather extraordinary given the prosecution argued and convicted House of murder based on a theory that whoever killed the victim did so to cover up the crime of rape); Schlup v. Delo, 513 U.S. 298, 327 (1995) (The Court addressed the actual innocence claim of a death row inmate. Loyd Schlup, however, had filed a previous habeas petition, and so was precluded procedurally from raising another petition. The Court permitted his petition to move forward on the basis that newly discovered evidence can excuse procedural default if, in light of the new evidence, it is "more likely than not that no reasonable juror would have convicted him." Significantly, the Court did not hold that claim of innocence provides a basis for relief—only that the Court may hear procedurally defaulted claims of constitutional violations if a petitioner can provide enough evidence to pass through the innocence gateway provided in this case.); Brandon L. Garrett, *DNA and Due Process*, 78 FORDHAM L. REV. 2919 (2010) [hereinafter Garrett, *DNA*].

[183] State *ex rel.* Holmes v. Court of Appeals, 885 S.W.2d 389, 399 (Tex. Crim. App. 1994).

[184] The Antiterrorism and Effective Death Penalty Act of 1996's deference requirements are evidence of that aversion. *See supra* Part IV.A.2.

[185] Lee Kovarsky, *AEDPA's Wrecks: Comity, Finality, and Federalism*, 82 TUL. L. REV. 443, 445 (2007).

trials, in no small part because the Constitution offers unparalleled protections against convicting the innocent."[186] That was in 1990, when only one individual, Gary Dodson, had been exonerated by DNA evidence and before hundreds of exonerations exposed the fault lines of the criminal justice system. Of course, it goes without saying that, while there are correlations between constitutional error and innocents being convicted, there is no reason a constitutionally fair trial would guarantee that an innocent is not convicted.

3. State and Federal Innocence Statutes Have Begun to Turn the Tide, but Not Completely

In some sense, the tide may have turned since *Herrera*, at least rhetorically: the *Osborne* court gave its strongest hint yet that a stand-alone innocence claim might be available and might be available to non-capital petitioners.[187] Retired Justice John Paul Stevens acknowledged the very real risk of innocents being wrongly convicted and sentenced to death.[188] Also retired Justice O'Connor's view of the death penalty changed, both because of its unfair administration and because of the growing number of exonerations in the country.[189] Lastly, virtually all the states and the federal government have, in the wake of hundreds of exonerations, enacted legislation (or interpreted existing legislation) that permits an individual convicted of a crime to raise innocence claims in state courts.[190] Those statutes differ from state to state—with some states limiting the claims to those based only on biological evidence,[191] some imposing strict time frames in which an individual may bring a claim of actual innocence while others permit application at any time,[192] some requiring

---

186 *Herrera*, 506 U.S. at 420 (O'Connor, J., concurring).

187 *See Osborne*, 557 U.S. at 67–70; Garrett, *DNA*, *supra* note 182, at 2951.

188 Findley, *Defining*, *supra* note 149, at 1175.

189 *See Second Thoughts*, TEP, http://www.tep-online.info/laku/usa/dp/doubts2.html. (last visited Nov. 3, 2016).

190 *See generally* INNOCENCE PROJECT, http://www.innocenceproject.org/about/ (last visited Nov. 3, 2016) (discussing a dedication to exonerate wrongfully convicted individuals). Arizona has no specific mechanism to raise claims of innocence through newly discovered evidence, though they can be raised in a motion for a new trial within 30 days of conviction. Perversely, claims of newly discovered evidence cannot be raised in post-conviction because the courts have found that innocence claims are a direct attack on the conviction, and post-conviction under Rule 37 is a collateral attack on the conviction. *See, e.g.*, Walters v. Iowa, 843 N.W.2d 477 (Iowa Ct. App. 2014). Connecticut has no specific statute, but case law recognizes claims of new evidence as grounds for innocence in habeas corpus; the burden of proof is extraordinarily high. *See* Gould & Taylor v. Comm'r of Corrs., 22 A.3d. 1146 (Conn. 2011) (discussing Miller v. Comm'r of Corr., 700 A.2d 1108 (Conn. 1997)).

191 *See Osborne*, 557 U.S. at 62–63.

192 The District of Columbia and Maryland permit applications at any time, and grant discretion to a court to summarily dismiss second or successive applications. *See, e.g.*, D.C. Code Ann. § 22-

different levels of proof, as between a preponderance of the evidence or clear and convincing evidence,[193] and some granting different relief based on the level of proof.[194]

In broad strokes, most of these statutes require the clear identification of new evidence; that the new evidence have been unavailable at the time of trial, even with an exercise of due diligence; that the evidence goes beyond being impeaching and is not cumulative; and a verification under oath of the individual's innocence.[195] Most states require a showing of clear and convincing evidence of actual innocence for exoneration;[196] some states require a showing that no reasonable trier of fact would have convicted the petitioner;[197] others require a showing—by a substantial probability or significant possibility—that the result would have been different at trial.[198] Some states permit consideration of new evidence *only* if it is scientific; and only Texas and California explicitly permit, by statute, vacature of a conviction based on changed scientific understanding. Some states, like Maryland, have interpreted "new evidence" to include a change of scientific knowledge that renders the trial in a new light.[199] Several states, however, restrict through statute[200] or through case law[201] claimants entitled to seek relief even in DNA to defendants who have gone to

4131 (West 2016); MD. CODE ANN., CRIM. PROC. § 8-301 (LexisNexis 2016). Some states, like Virginia, impose a 60 day limit from the time reports of biological testing are published. VA. CODE ANN. § 19.2-327.3 (2016). Virginia limits an individual to a single application. VA. CODE ANN. § 19.2-327.10 (2016).

193 *See, e.g.*, D.C. CODE ANN. § 22-4131 (2016); MD. CODE ANN., CRIM. PROC. § 8-301 (LexisNexis 2016) (Maryland and the District of Columbia are good examples of different levels of proof providing different relief: proof of innocence by a preponderance of evidence entitles an individual to a new trial, while proof of innocence by clear and convincing evidence entitles one to a straightforward vacature of conviction.).

194 CAL. PENAL CODE § 1181 (West 2016).

195 D.C. CODE ANN. § 22-4135 (2016); VA. CODE ANN. § 19.2-327.10 (2016) (non-biological evidence); VA. CODE ANN. § 19.2-327.2 (2016) (enacted in 2001 for biological evidence).

196 *See, e.g.*, D.C. CODE ANN. § 22-4131 (2016); MD. CODE ANN., CRIM. PROC. § 8-301 (LexisNexis 2016).

197 *See, e.g.*, VA. CODE ANN. § 19.2-327.13 (2016).

198 *See, e.g.*, MD. CODE ANN. CRIM. PROC. § 8–301 (LexisNexis 2016).

199 *See generally* Ward v. State, 108 A.3d 507 (2015); Lucas v. Maryland, No. 192240032-33 (Md. Cir. 1994) (on file with authors).

200 OHIO REV. CODE ANN. § 2953.72(c)(2) (LexisNexis 2015) ("An offender is not an eligible offender under division (C)(1) of this section regarding any offense to which the offender pleaded guilty or no contest.").

201 *See, e.g.*, Williams v. Erie County District Attorney's Office, 848 A.2d 967, 972 (Pa. Super. Ct. 2004); Graham v. State, 188 S.W.3d 893 (Ark. 2004); Jamison v. Maryland, No. 6, 2016 WL 6755922 (Md. Ct. Spec. App. Nov. 15, 2016). Maryland also prohibits the issuance of a writ of actual innocence in the case of non-biological new evidence when the petitioner entered a guilty plea or an *Alfred* plea, which, under Maryland law, is the equivalent of a guilty plea. Yonga v. Maryland, 130 A.3d 486 (Md. Ct. Spec. App. 2016).

trial, and preclude those who have taken guilty pleas or entered *Alfred* pleas from being exonerated and even obtaining DNA testing.

B. The Weight of Innocence in Arson Prosecutions

There is no better demonstration of the near insurmountable challenges individuals face in post-conviction proceedings than in arson post-conviction proceedings. Essentially, there are two practical ways of litigating post-conviction cases involving arson science: First, as a claim of newly discovered evidence based on scientific development within the framework of innocence protection statutes, or traditional collateral procedures provided by state and the federal government, based on claims involving a due process violation; second, and particularly relevant for cases investigated after widespread acceptance of the NFPA 921 or cases of expert overreach, a claim in collateral proceedings that the government presented false or misleading evidence.

1. New Evidence Method

The "new evidence" method can be employed under stand-alone innocence protection statutes or on collateral appeal, under exceptions to procedural bars such as statutes of limitations or bars on successive challenges to a conviction. These challenges involve the argument that the new evidence is updated research which reveals the "science" used at trial to have been incorrect—the new evidence is, in other words, the newly discovered or the new perspective on science, and that, as a result, the petitioner deserves a new trial or has proven their actual innocence. Several successful cases followed this route, which was outlined in a groundbreaking article by Caitlin Plummer and Imran Syed of the University of Michigan Innocence Clinic,[202] who represented David Gavitt in one of the first exonerations based on the new understanding of fire investigation.

The "new evidence" method has been successful in a variety of contexts. Seven individuals successfully argued in court that the changed or "shifted" science was new evidence: Ray Girdler, Jr.,[203] Andrew Babick, Kristine

---

[202] *See generally* Caitlin Plummer & Imran Syed, *"Shifted Science" and Post-Conviction Relief*, 8 STAN. J.C.R. & C.L. 259 (2012).

[203] Girdler v. Dale, 859 F. Supp. 1279 (D. Ariz. 1994) (explaining that State experts testified in 1990 that accelerants were used to set an intentional fire when the evidence could have also been caused by an accidental fire. The federal district court hearing the habeas petition granted a second trial in 1994 after experts showed that the evidence used to convict could have been caused by an accidental fire due to a better understanding of flashover.).

Bunch,[204] David Lee Gavitt,[205] Tonya Lucas,[206] Joseph Awe,[207] and most recently, William Amor.[208] This argument has been persuasive in the context of

[204] Michigan v. Babick, No. 1996-2562 (Mich. Cir. Ct. 2014) (granting relief in part on the basis of refined understanding of fire science) (on file with authors); Bunch v. State, 964 N.E.2d 274 (Ind. Ct. App. 2012) (finding a claim for merit as well because the government had failed to produce reports that other claims were denied on the grounds that her defense experts had testified similarly at trial).

[205] Gavitt filed a post-conviction petition seeking a new trial based on the fact that newly discovered scientific evidence, in the form of a shift in scientific understanding and analysis, proved that the fire was not arson and all the alleged fire science used at the time of trial (1985, seven years before the first edition of the NFPA 921) was flawed, from the investigation to the interpretation of gas chromatography tests. After reviewing the affidavits submitted by Mr. Gavitt and conducting an independent review of the case, the state agreed that the testimony at trial was flawed and that the cause and origin of the fire were undetermined; they dismissed the charges against Mr. Gavitt. *See* Gavitt v. Born, No. 14-12164, 2015 WL 5013844 (E.D. Mich. Aug. 24, 2015); *Man Cleared of Killing His Wife and Two Daughters in House Fire After 26 Years in Prison*, DAILY MAIL (June 7, 2012), http://www.dailymail.co.uk/news/article-2156050/David-Lee-Gavitt-cleared-killing-wife-children-house-26-years-prison.html; John Masson, *Clinic Earns Murder Exoneration After 27 Years*, MICH. L. (June 7, 2012), https://www.law.umich.edu/newsandinfo/features/Pages/gavitt_exoneration.aspx.

[206] On Lucas's writ of actual innocence, the state conceded that fire science evidence was newly discovered evidence and that the state's fire science experts' opinions at trial that the fire was not accidental, the fire was intentionally set, that an accelerant was used and present at the fire scene, and that the petitioner's clothing indicated the presence of an accelerant were no longer valid. *See* Lucas v. State, Case No. 192240032-33 (Md. Cir. 1994) at *3. The *Lucas* court noted that the newly discovered evidence—which the court called "indisputably and irreparably flawed"—did not demonstrate petitioner's actual innocence, but rather, created "a substantial or significant possibility that the result may have been different." *Id.* at *18. The court also noted, citing five cases, that "[l]ay jurors tend to give considerable weight to scientific evidence when presented by 'experts' with impressive credentials." *Id.* at *19. Lucas benefited from an important decision of the Maryland Court of Appeals in 2015, which held that newly discovered evidence includes "later discovered scientific evidence which casts doubt upon the validity and admissibility of evidence that was introduced at the time of trial," specifically, the admissibility and reliability of the state's fire expert testimony which was corroborated by an unreliable witness. *Ward*, 221 Md. App. at 163. A petition for certiorari was filed but has been denied. Lucas v. State, 650 A.2d 239 (Md. 1994), *cert. denied*.

[207] Joseph Awe filed a state petition for a new trial and used the fact that NFPA 921 was updated to warn against "Negative Corpus" to show a change in the science, and the motion was therefore granted. *See* State v. Awe, No. 07 CF 54 (Wis. Cir. Ct. 2013), http://thearsonproject.org/charm/wp-content/uploads/2014/06/WI_v_Awe.pdf (order granting motion for new trial). What was "new" was that Mr. Awe's case was now "very much enhanced by the maturing standard which now recognizes the 'negative corpus' methodology leads to wrong results." *Id.* at 2. Comparing the case at hand to previous cases involving shaken baby syndrome, the court pointed out that the new evidence—the shift of mainstream opinion—essentially suggested an alternate cause. *Id.* at 2–3.

[208] William Amor was convicted of setting a fire that killed his mother in law. *William Amor*, ARSON RES. PROJECT, http://thearsonproject.org/case-studies/william-amor/ (last visited Nov. 3, 2016). After 17 hours of continuous interrogation, he confessed that he had soaked newspaper in vodka and set the newspaper aflame with a cigarette. *Id.* He and his wife were at a drive in movie theater at the time of the fire. Clifford Ward, *Naperville Man Gets Hearing to Dispute Conviction*

executive clemency: in Virginia, Davey Reedy received a full gubernatorial pardon on the basis that the fire science presented in court in 1987 was no longer reliable.[209] It has also been persuasive in the context of traditional federal habeas petitions: George Souliotes presented new scientific evidence to argue that his procedural default on his constitutional claims should be allowed to pass through the *Schlup* gateway.[210] In *People v. Souliotes*,[211] no qualified experts could determine the fire's cause and the medium petroleum distillates found at the fire scene and on Souliotes's shoes were determined to be different from each other.[212] The federal district court found that it was more likely than not that a reasonable juror would have had reasonable doubt this new evidence satisfied *Schlup*'s exculpatory scientific evidence option.[213] Due to this finding, Souliotes obtained relief on his constitutional claims.[214] But, as will be described more fully below, this argument has proven challenging to individuals who presented a defense at trial or whose cases were tried after scientists had accepted the NFPA 921 as the guiding standard of fire investigation.

Other significant cases have proceeded through traditional habeas, employing constitutional claims.[215] The most interesting and significant of those

in 1995 Fatal Arson, CHI. TRIB. (May 13, 2016, 7:14 PM), http://www.chicagotribune.com/suburbs/naperville-sun/ct-naperville-arson-met-20160513-story.html. At the time of this writing, Mr. Amor is awaiting a hearing on his post-conviction petition. *Id.* A hearing was granted for the purpose of determining whether Mr. Amor was entitled to file successive petitions for post-conviction relief, and to decide if fire and explosion science had evolved enough to call into question Mr. Amor's confession (which he argued was coerced) and lead to a different result at trial. *Id.* Mr. Amor's attorneys argued that the fire investigation techniques used today, which were not available at the time of Mr. Amor's trial, disprove the state's theory of arson and that the fire techniques used at trial are no longer generally accepted in the field. *Id.*

209 Laurence Hammack, *Gov. Terry McAuliffe Pardons Roanoke's Davey Reedy*, ROANOKE TIMES (Dec. 22, 2015, 8:37 PM), http://www.roanoke.com/news/crime/roanoke/gov-terry-mcauliffe-pardons-roanoke-s-davey-reedy/article_39e4c36b-d990-557a-9201-74dbbd8f2b3e.html.

210 Souliotes v. Hedgpeth, No. 1:06-CV-00667 AWI, 2012 WL 2684972, at *3 (E.D. Cal. July 6, 2012).

211 *See* People v. Souliotes, No. F036905, 2002 WL 1797243 (Cal. Ct. App. 2002).

212 *Id*.

213 *Hedgepeth*, 2012 WL 2684972, at *3–4. The Supreme Court in *Schlup* "enumerated three categories of new reliable evidence: 'exculpatory scientific evidence, trustworthy eyewitness accounts, or critical physical evidence.'" Brummett v. Valenzuela, No. 1:12-CV-00119 MJS HC, 2012 WL 4092381, at *14 (E.D. Cal. March 3, 2014) (quoting Schlup v. Delo, 513 U.S. 298, 324 (1995)).

214 *See Souliotes*, No. F036905, 2002 WL 1797243 (Cal. Ct. App. 2002).

215 Daniel Dougherty won a new trial based on a claim of ineffective assistance of counsel for defense counsel's failure to challenge, in a 2000 trial, what state investigators' methodology and conclusions were from 1985. Jeff Gammage, *Retrial for Man Who Spent 17 Years in Prison for Fire That Killed His Children*, PHILLY.COM (Mar. 21, 2016), http://articles.philly.com/2016-03-22/news/71735523_1_john-lentini-han-tak-lee-arson. *United States v. Hebshie* involved a § 2255

cases is *Han Tak Lee v. Houtzdale*,[216] which involved a state conviction on a federal habeas claim.[217] Han Tak Lee successfully claimed that his conviction was based on inaccurate and unreliable evidence and that his continued incarceration violated due process because newly discovered scientific evidence showed he was probably innocent.[218] Specifically, the prosecution presented testimony that 62 *gallons* of home heating fuel and 12.2 *pounds* of Coleman fuel was used to set fire to a cabin—despite the fact that gas chromatography showed that none of the eight identified origin sites showed evidence of accelerants and later testing proved that the pretrial testing that found accelerants on Lee's clothing was incorrect.[219]

2. The Problem with New Evidence Claims

The "new evidence" strategy, while promising in some instances, remains potentially problematic in cases in which defense counsel hired experts and presented relevant and accurate testimony at trial that was simply outweighed by the prosecution evidence. The "new evidence" strategy may become more and more of an impediment for modern cases as fire investigation makes subtle progress. Two cases are useful examples: Kristine Bunch, who was very nearly denied relief precisely because her experts at trial concluded that the fire was in all likelihood accidental,[220] and Samuel Anstey, who was denied relief precisely because his trial counsel properly identified issues upon which to cross examine the state's experts, including their failure to abide by procedures outlined in NFPA 921.[221]

The state's case in *Bunch* relied largely on expert testimony that the fire began in two distinct locations based on three things: visual inspection and laboratory testing of floor samples which indicated the presence of liquid accelerant, V-patterns that pointed downward, and the myth that fires do not burn

petition claiming ineffective assistance of counsel for failure to raise a *Daubert* objection on dog alert evidence, failure to seek hearing on gas chromatography, and failure to request a hearing on cause and origin evidence. *See* United States v. Hebshie, 754 F. Supp. 2d 89, 103–22 (Mass. Dist. Ct. 2010). The court granted the petition because of the outrageous testimony of the dog handler, who claimed the alert dog had mystical properties, and because predecessor counsel had specifically warned trial counsel of the necessity of challenging the arson evidence and had lined up experts, which trial counsel dismissed despite the court repeatedly inviting such a challenge. *See id.* at 98–128.

216 Lee v. Houtzdale SCI, 798 F.3d 159 (3d Cir. 2015).

217 *Lee*, 798 F.3d at 162–63.

218 *Id.* at 169.

219 *Id*. at 167.

220 *See* Bunch v. State, 964 N.E.2d 274, 281–311 (Ind. Ct. App. 2012).

221 *See* Anstey v. Ballard, 787 S.E.2d 864 (W. Va. 2016).

low absent the use of accelerant.[222] The laboratory analyst testified that five of the flooring samples indicated the presence of accelerant.[223] Bunch offered evidence at trial that there were electrical problems at her home, and her fire investigation expert testified that the cause of the fire should be classified as undetermined.[224]

On post-conviction, Bunch presented the testimony of John DeHaan, who stated that at the time of Bunch's trial the effects of flashover were not well understood, and that many of the phenomena previously associated with incendiary fires and accelerants, such as deep V-patterns, holes in the floor, deep charring, and pour patterns, were in fact a result of flashover.[225] He further testified that he did not see any evidence of an intentional fire.[226] A second expert, John Malooly also testified in support of Bunch's post-conviction motion, stating that there was no basis upon which to determine this fire was incendiary and that the phenomena the state used as support for that conclusion were a result of flashover; Malooly went on to assert that the effects of flashover were not well understood at the time of Bunch's trial, and that the state's experts at trial described these phenomena poorly and misattributed them to an intentional fire.[227]

The lower court relied on the fact that Bunch presented a defense at trial to hold that she was not presenting anything genuinely new—that the post-conviction facts and claims simply repackaged the defense witnesses' testimony.[228] Thus, the court barred relief on the ground that the evidence was not new, was cumulative, and was "merely" impeaching, barring relief on the basis of new evidence in the field of fire investigation as cumulative.[229] In other words, because the new experts on post-conviction could not determine definitively that the fire was caused by accident, their testimony was rejected on the basis that it merely impeached the testimony of the state's trial experts.[230] Bunch's problem arose because she presented a defense at trial that was based

---

222 *Bunch*, 964 N.E.2d at 280. Other samples, including Bunch's nightgown, some mattress ticking, and tap strips and paneling were also sent to the laboratory, for a total of 10 pieces of evidence. *Id.*

223 *Id.*

224 *Id.*

225 *Id.* at 310 (Crone, J., dissenting).

226 *Id.*

227 *Id.* at 310–11 (Crone, J., dissenting).

228 *Id.* at 283–84 (majority opinion).

229 *See id.* at 290–98. Indiana's post-conviction statute requires proof of nine factors: (1) the evidence has been discovered since the trial; (2) it is material and relevant; (3) it is not cumulative; (4) it is not merely impeaching; (5) it is not privileged or incompetent; (6) due diligence was used to discover it in time for trial; (7) the evidence is worthy of credit; (8) it can be produced upon a retrial of the case; and (9) it will probably produce a different result at retrial. *Id.* at 283.

230 *Id.* at 284.

on qualified fire investigation. That defense, ironically, worked against her effort to correct her wrongful conviction.[231]

Bunch ultimately obtained relief on fairly narrow grounds from the court of appeals. She was able to present new evidence in the form of toxicology evidence.[232] Bunch won on this victim toxicology testimony because NFPA 921 did not recommend consideration of the physiological condition of the victim until 2001, after Bunch's trial.[233] The court accepted the analogy between shifted fire science (specifically, victim fire toxicology) and DNA evidence to some degree, accepting that, like DNA testing of old evidence, fire victim toxicology improvements present a new interpretation of previously existing evidence.[234] However, the court still pointed out a significant difference between the two: unlike DNA analysis, which can point to a perpetrator or conclusively exclude a person, a shift in scientific understanding only makes one scenario more likely than another without offering conclusive proof.[235]

Samuel Anstey was not as fortunate. His case was dismissed without a hearing and affirmed throughout the appeals process.[236] The Supreme Court of Appeals of West Virginia recently affirmed the denial of relief on the grounds that Anstey's new experts offered evidence that was cumulative of evidence presented at trial (and cross examination of the state's experts at trial), and because it merely impeached the evidence promulgated by the state.[237]

Anstey claimed that advances in fire investigation were new evidence and that his imprisonment in light of the new evidence violated due process.[238] The Supreme Court of Appeals of West Virginia concluded that there was no appellate authority that stated that the methodology which departed from NFPA 921 was inadmissible or inherently unreliable (despite NFPA 921's admonition that procedures inconsistent with those outlined require justification and other indicia of reliability), that NFPA 921 was not accepted as authoritative in West Virginia, and that periodic amendments to NFPA 921 do not constitute newly discovered evidence.[239] But the court did not stop there: it described in detail that the two defense experts at trial concluded that the fire was accidental (likely having started as a result of a faulty lamp in the living room) and that the charred debris was in fact burned-out ceiling that was moved into the victim's room by firefighters and investigators (and not likely a result of two separate origins,

231 *See id.*

232 *Id.* at 304.

233 *Id.* at 288.

234 *Id.* at 289.

235 *Id.*

236 Anstey v. Ballard, 787 S.E.2d 864, 866–67 (W. Va. 2016).

237 *Id.*

238 *Id.* at 873–74.

239 *Id.*

which would indicate arson).[240] The court held the new evidence presented by Anstey was not material because it was cumulative of what was presented at trial and was only impeachment of the state's witnesses, as opposed to completely undermining or obliterating the testimony of the state's experts.[241]

Michael Ledford[242] finds himself in a similar position, with a paucity of avenues through which to clear his name. Ledford was convicted of killing his one-year-old son on the day of his first birthday party as a result of a fire that Ledford allegedly set in his apartment.[243] The evidence against him consisted of erroneous testimony by a state investigator that the living room in which the fire occurred experienced flashover and an insurance investigator's conclusion that the fire was a result of arson.[244] Both investigators came to this conclusion only after Ledford was interrogated—using discredited and dangerous interrogation tactics—and confessed, nearly a month after the fire.[245] The investigators changed their opinion about the area of origin and the cause after the confession, the facts of which did not fit the empirical evidence.[246] Neither arson investigator followed the NFPA 921 in their final analysis.[247] Moreover, the state's lay witnesses established a timeline (consistent with Ledford's own description of events) pursuant to which it would have actually been impossible for Ledford to have started the fire.[248] Ledford's trial counsel presented the testimony of a respected fire engineer and investigator, who explained that the state's theory of the case—an open flame—would have resulted in flashover within 2 or so minutes rather than the self-extinguishing fire that peaked a full 15 to 20 minutes after Ledford left the house.[249] Video of a test burn would have demonstrated this in a dramatic and visual way, but the court excluded this video from evidence

---

240 *Id.* at 872.

241 *Id.* at 874–79. The court distinguished *Anstey* from *Bunch* on the basis that *Bunch* lacked evidence of motive. *Id.* at 880 n.56.

242 *See The Imaginary Thrown Candle into a Polyurethane Chair*, INNOCENT IN PRISON, http://www.mikeledfordthrowncandle.com/ (last visited Nov. 3, 2016). Michael Ledford is represented by Parisa Dehghani-Tafti at the Mid-Atlantic Innocence Project (along with co-counsel from the law firm of Baker Botts) and Paul Bieber has provided expert counseling and a report in support of Mr. Ledford's efforts to regain freedom.

243 STEPHEN M. OLENICK ET AL., RE-VISITING THE MICHAEL LEDFORD FIRE INCIDENT 2 (2010), http://www.mikeledfordthrowncandle.com/uploads/2/7/3/6/2736084/cse_isfi_2010_paper_color.pdf.

244 JOHN B. ALLEN, IN THE MATTER OF MICHAEL L. LEDFORD, # 1014878, PETITIONER: PETITION FOR ABSOLUTE PARDON 160–62 (2012), http://www.skepticaljurordocs.com/documents/2013/05/ledford-petition-absolute-pardon.pdf.

245 *See id.* at 5–18.

246 *Id.* at 5.

247 *See id.* at 29.

248 *Id.* at 22.

249 *See id.* at 161.

and the jury found Ledford guilty.[250] In spite of the evidence that Ledford did not start the fire, he still faces significant hurdles because he has exhausted or defaulted the procedural avenues available to him.[251]

3. False Evidence

Although an arson case has yet to be decided on the basis of false evidence being presented,[252] it is hardly a stretch to apply the lessons of the hair microscopy review conducted by the FBI in collaboration with the Department of Justice ("DOJ") and the National Association of Criminal Defense Lawyers ("NACDL") to arson. These lessons should apply particularly in cases that post-date the widespread acceptance of NFPA 921 and cases in which experts are permitted to testify beyond their area of expertise. In 2013, the FBI and the DOJ, in collaboration with the NACDL and the Innocence Project, initiated an internal review of all cases in which the FBI laboratory performed microscopic hair analysis and in which FBI agents provided testimony at trial.[253] In theory, hair microscopy analysis purported to differentiate between individuals based on qualities of their hairs. The theory behind hair microscopy was that an individual could be included or excluded from the population of potential donors who could have deposited hair at the crime scene based on how similar or dissimilar the suspect's hair was to the forensic sample.[254] In practice, the 2013 FBI review concluded that in more than 95% of cases, analysts overstated what their hair microscopy could possibly prove and actually gave the impression that the defendants' hairs were *identical* to the hairs left at the crime scene, often stating that in thousands of analyses the analyst in question had never seen two hairs so closely similar or claiming they could differentiate between the hairs of identical

250 *Id.* at 22.

251 *Id.* at 5.

252 Souliotes v. Grounds, No. 1:06–CV–00667 AWI, 2013 WL 875952, at *15–17 (E.D. Cal. Mar. 7, 2013). George Souliotes pursued a claim of presentation of false evidence under *Napue v. Illinois*, but those claims were denied on the basis that although evidence used to convict Souliotes was false and prejudicial, the false evidence was presented in good faith. *Id.* at *16. The federal district court granted relief on other grounds. *Id.* at *59. An ongoing California case argues that the introduction of false arson science at a trial predating NFPA 921's recognition as a standard violated Joann Parks's due process rights. *JoAnn Parks*, CAL. INNOCENCE PROJECT, https://californiainnocenceproject.org/read-their-stories/joann-parks/ (last visited Nov. 3, 2016). This case, discussed in more detail below, also relies on California's newly added habeas provision, which permits a petitioner to seek relief on the basis that the scientific evidence presented at trial and material to petitioner's guilt has been "undermined by later scientific research or technological advances." CAL. PENAL CODE § 1473(e)(1) (West 2016).

253 Norman L. Reimer, *The Microscopic Hair Comparison Analysis Review Project: A Milestone in the Quest for Forensic Science Reform (Inside NACDL)*, NACDL (May 2015), https://www.nacdl.org/Champion.aspx?id=37319&terms=hair+analysis.

254 *See id.*

twins.[255] Those cases can be litigated on three claims: presentation of false evidence by the prosecution under *Napue v. Illinois*,[256] misleading evidence under *Alcorta v. Texas*,[257] or a fundamental fairness argument that one should not be convicted and imprisoned on evidence that is learned to be false after trial.[258]

It is a due process violation for the government to obtain a conviction through the use of false or misleading evidence.[259] To succeed on a traditional claim that false or misleading evidence was presented at trial, a petitioner needs to prove that the false or misleading evidence was introduced at trial and that there is "any reasonable likelihood" the evidence "affected the judgment of the jury."[260] Of course, the presentation of false evidence needs to be deliberate on the part of the prosecutor, even if it is simply a failure to correct unsolicited false evidence.[261] Promulgation of false evidence and nondisclosure of exculpatory evidence are intertwined in the sense that the underlying goal of categorizing both violations as constitutional violations is the need to preserve the truth-finding process and to avoid unfair trials.

In the context of arson prosecutions this argument would be particularly relevant in post-2000 cases, after the DOJ declared NFPA 921 as the benchmark of fire investigation, or in cases where an expert overreached in their testimony. While generally it is required that the falsity was hidden from the defense or not capable of being discovered, scientific or technical testimony has the imprimatur of truth when presented by the state.[262] Since testimony from state experts is frequently provided by state employees who are not specifically collecting a fee for their testimony—and therefore *appear* to be objective—jurors assume that the court has performed a gatekeeper function and is only permitting valid evidence.[263] More often than not, these state employees testify that a fire was arson, a fingerprint matches, DNA is consistent—all forms of testimony that are

---

255 Spencer S. Hsu, *FBI Admits Flaws in Hair Analysis Over Decades*, WASH. POST, (Apr. 18, 2015), https://www.washingtonpost.com/local/crime/fbi-overstated-forensic-hair-matches-in-nearly-all-criminal-trials-for-decades/2015/04/18/39c8d8c6-e515-11e4-b510-962fcfabc310_story.html. The review was initiated after the NAS report identified permissible and improper uses of the practice and after DNA testing proved the analysis to be flawed. After finishing its review of the first 268 cases, the FBI has reported that improper testimony was presented in more than 95% of the reviewed cases involving hair microscopy. *Id.*

256 360 U.S. 264, 269 (1959).

257 355 U.S. 28, 30–32 (1957).

258 *See* Chambers v. Mississippi, 410 U.S. 284 (1973).

259 *See, e.g.*, *Napue*, 360 U.S. at 264; *Alcorta*, 355 U.S. at 28.

260 *Napue*, 360 U.S. at 271.

261 *Alcorta*, 355 U.S. at 31–32.

262 *See* Bennett L. Gersham, *The Prosecutor's Duty to Truth*, 14 GEO. J. LEGAL ETHICS 309, 315 (2000–2001).

263 *Id.*

definite, understandable, and consistent with expectations from television and crime shows. Defense experts, in contrast, are almost inevitably paid experts and tend to testify that a fire's cause was undetermined, that fingerprints are not consistent with the defendant, that a lab did not follow their own protocols, or that population statistics with respect to DNA are misleading—none of which is testimony that inspire confidence or resolves the who-done-it in a neat way, and none of which affirmatively proves "the truth." Indeed, in Mr. Ledford's case, the state presented testimony that the fire had started on top of a chair cushion with an open flame (with a candle).[264] It was a persuasive, coherent story. In contrast, very reputable defense experts were left testifying that it could not have happened with an open flame (without causing flashover in two minutes) but were unable to describe what did happen because of court rulings and the destruction of the fire scene and its contents.[265] It was a less compelling story, even though it was more accurate.

Han Tak Lee offers some hope because it squarely held that it is a due process violation to be convicted and incarcerated on the basis of incorrect evidence.[266] The next reasonable step is for trial counsel to make constitutional arguments that certain types of purportedly scientific evidence violate a defendant's right to due process because they are unvalidated, unscientific evidence. These constitutional arguments would apply to evidence being used by the state in arson cases which implicitly relies on Negative Corpus, which involves unsubstantiated canine alerts, which relies too heavily—and in the face of other empirical evidence—on witness statements. The constitutional arguments go beyond the standards of reliability outlined by evidentiary rules, but to something more fundamental, namely, that the right to a fair trial is implicated in the admission of evidence for which an error rate cannot be identified (or the error rate is intolerably high), for evidence that has not been scientifically demonstrated to be accurate, or for evidence that overreaches the bounds of the witnesses' expertise.

V. PROPOSED SYSTEMIC SCIENTIFIC AND LEGISLATIVE REFORMS

If more than 1,900[267] individuals who have been exonerated as of this writing prove anything, it is that there are presently countless prisoners locked up in the United States for crimes they did not commit. But none of the post-conviction remedies within our criminal justice system—not direct appeals, not habeas review, not even all actual innocence claims—provides incarcerated individuals with a meaningful path to prove their innocence. This is particularly

264 *See* ALLEN, *supra* note 244, at 153.

265 *See id.* at 28.

266 Lee v. Houtzdale SCI, 798 F.3d 159, 162 (3d Cir. 2015).

267 *See The National Registry of Exonerations*, *supra* note 3.

true for those convicted of arson crimes on the basis of junk science. Therefore, in order to properly address the seemingly irreconcilable conflict challenges raised by a criminal justice system built on finality but dependent on science, the time has come for us to consider systemic reforms, not just to the specific techniques of fire and arson investigation, but also more importantly to the broader question of how we legislate and litigate innocence claims in the context of evolving scientific norms.

A. Systemic Scientific Reforms

The first area of systemic reform is improving the science itself. Fire investigation has come a long way since Hak Tan Lee, Todd Willingham, and David Lee Gavitt were convicted of intentionally setting fires that killed their families. Since the publication of NFPA 921, the increased reliance on a systematic process and the scientific method has clearly helped to move fire scene examination towards a more stable footing. NFPA 921's recent rejection of Negative Corpus as an acceptable methodology was a significant boost to the discipline's credibility.

However, lingering questions persist in regards to the underlying reliability and validity of some techniques. And while some clearly unscientific and outdated techniques have been rejected ("pour-pattern," crazed-glass, concrete spalling, etc.), other equally unreliable and unmeasured processes (area of origin determination in a post-flashover fire, unconfirmed alerts of accelerant detection canines, negative corpus, etc.) have taken their place, resulting in changing the process, but maintaining the result in the form of a new generation of wrongful arson convictions. When it comes to making genuine improvements to a field of forensic science, exchanging one set of outdated and unmeasured methodologies with a new set of equally unreliable techniques is no improvement at all.

But there is much that can still be improved, beginning with a genuine effort by the fire investigation community to rigorously measure the foundational reliability and rate of error of every forensic methodology on which they propose to proffer expert testimony. These improvements will require coordinated efforts between federal and state government agencies, attorneys, and the scientific community to ensure that imprisoned individuals convicted of arson or arson-related killings receive a hard and fair look at their cases, that future defendants are tried on accurate and scientifically valid evidence, and that the science of fire investigation continues to engage in and learn from the scientific method. To that end, there are several (not exhaustive) categories of reform we propose:

1. Recognizing the Level of Damage and Its Effects on Accuracy

The reliability and accuracy of conclusions in any forensic domain are directly related to the quality and quantity of physical evidence available for

examination and the methodologies used to analyze that evidence. Flashover, full-room involvement, building collapse, and extended overhaul are just a few of the factors that create complex fire-scene conditions that negatively affect the amount and clarity of information contained in the physical evidence and tend to limit the fire investigator's ability to draw reliable, valid, and specific conclusions based on fire-pattern and fire-dynamics analysis. Guidelines and training assist the fire investigator in recognizing the threshold of damage beyond which otherwise acceptable methodologies lose their value is sorely needed.

The reliability and accuracy of area of origin determination in post-flashover, ventilation controlled fire conditions are simply unknown. Research is needed to develop specific methods and procedures in determining a fire's true area of origin under these conditions. Until such methodologies are developed, tested, and measured for accuracy, fire investigators should limit their area of origin determination to the "room of origin" or another area of sufficient size to encompass all possible locations where the fire might have begun.

2. Witness Statements

The misuse of witness statements in fire investigation is both concerning and widespread. Greater clarity is needed in guidelines and training to assist the fire investigator in understanding that a witness's statement may be helpful to develop a working hypothesis regarding the origin, cause, or development of a fire, but final conclusions must be based on the application of accepted methodologies to the examination of physical and empirical evidence.

3. Negative Corpus

In spite of NFPA 921's recent rejection of the Negative Corpus methodology as a clear violation of the scientific method, it remains a common practice among fire investigators to base expert conclusions on the absence of physical evidence.[268] Stronger measures, in the form of professional standards and targeted training, are needed for NFPA 921's guidelines to be understood and accepted by forensic fire-scene examiners.

4. Inclusion and Exclusion of Electrical Appliances

Elimination of an electrical appliance or electrical conductor as a heat or ignition source by visual examination, especially in the field, is a common and troubling feature of many fire-scene examinations.[269] Further research is needed to measure the reliability and accuracy of fire investigators in excluding or

[268] *See* Guy E. Burnette, Jr., *Origin and Cause: Legal Standards of Proof*, INTER FIRE ONLINE, http://www.interfire.org/res_file/oclegal.asp (last visited Nov. 3, 2016).

[269] ALLEN, *supra* note 244, at 168.

including electrical appliances and the investigator's ability in recognizing and attributing post-fire artifacts. Standardized examination methodologies and procedures, that are tested for error and accuracy, would assist in meeting this need.

5. Acknowledging and Minimizing Bias

The presence and impact of role bias, expectation and confirmation bias, and selective re-examination bias in fire investigation is subtle, but real. More research on the real-world effects of biasing information on fire-scene examination is needed. Until policies and standards are developed to minimize and control the underlying causes of cognitive bias, the reliability of conclusions based on fire-scene investigation will remain controversial.

6. Shielding Fire Investigators from Domain-Irrelevant Information[270]

The current framework for fire-scene examination, specifically within the public sector, can expose fire investigators to ancillary information that is neither within their forensic domain nor relevant to the purpose of the examination that they are tasked to perform. Appropriate policies will go some way to protect the origin-and-cause investigator from this type of information. Adopting the recommendations developed by the National Commission on Forensic Science in the area of shielding forensic practitioners from exposure to task-irrelevant information would be an excellent first step in meeting this challenging goal.[271]

In those circumstances where, in spite of policies to the contrary, a fire-scene examiner is exposed to biasing information, a system for the examiner to recuse himself or herself from the investigation and be replaced with an examiner that has not been exposed to the biasing information should be used.

7. Context-Free Secondary Examinations

Secondary examinations must be conducted in an environment free of contextual biasing information, where expert conclusions are based only on evidence relevant to the secondary examiner's area of expertise. When requesting a secondary examination, policies should shield the secondary examiner from potentially biasing information and from the conclusions of previous examiners. In fire investigation, protocols designed to allow for the

---

[270] Itiel E. Dror, *Practical Solutions to Cognitive and Human Factor Challenges in Forensic Science*, 4 FORENSIC SCI POL'Y & MGMT. 105 (2013).

[271] *See* NAT'L COMM'N ON FORENSIC SCI., ENSURING THAT FORENSIC ANALYSIS IS BASED UPON TASK-RELEVANT INFORMATION (2015), https://www.justice.gov/ncfs/file/641676/download.

sequential unmasking of evidence can be of particular value in a context-free, secondary examination setting.[272]

8. Separating Fire-Scene Examination from Criminal Investigation

Separating the role of the origin-and-cause examiner from that of the criminal investigator is perhaps the single most critical improvement to current fire-investigation practice and almost certainly the most difficult to accomplish. The current culture of the public-sector fire investigator participating in both the scene examination and the wider criminal investigation is well entrenched. The formation of teams made up of fire department origin-and-cause examiners with police detectives specializing in arson investigation is especially problematic, as it tends to reinforce the overlap of the two vocations rather than separate them.

It is crucial to an objective forensic analysis that the two roles be separate. A forensic examiner conducting a fire-scene examination for the purpose of determining the area of origin and causation of a fire must not participate in any parallel or subsequent criminal investigation based directly or indirectly on his origin-and-cause conclusions. This is the recommendation contained in the *NAS Report* to discourage the effects of cognitive bias and promote independence and objectivity in a reliable and professional forensic analysis.

9. Exclusion of Questionable Testimony

The Texas Forensic Science Commission's ("FSC") report on Willingham encouraged trial lawyers in criminal cases to "aggressively pursue admissibility hearings in arson cases" because of the rapidly changing discipline and the still-unshakable wrong beliefs presented by purported experts.[273] The report also pointed out that forensic disciplines have a "(1) duty to correct; (2) duty to inform; (3) duty to be transparent; and (4) [duty to] implement[] corrective action" when new scientific knowledge develops.[274]

---

272 Dan E. Krane et al., *Sequential Unmasking: A Means of Minimizing Observer Effects in Forensic DNA Interpretation*, 53 J. FORENSIC SCI. 1006, 1006 (2008).

273 TEX. FORENSIC SCI. COMM'N, WILLINGHAM/WILLIS INVESTIGATION 48 (2011), http://www.fsc.state.tx.us/documents/FINAL.pdf.

274 *Id.* at 41.

10. Accelerant Detecting Canines

The limitations expressed in NFPA 921[275] and the CADA position[276] paper regarding the use of accelerant detecting canines and portable hydrocarbon detectors should be understood and followed. Policies should be developed that recognize the difference between a presumptive test, such as a dog alert, and a confirmatory test, such as GC/MS analysis, and the level of confidence to be placed in each. Canine alerts, particularly in the context of negative gas chromatography results, are like police testifying that they believed a defendant possessed cocaine when the lab results on the evidence recovered from the suspect were negative for cocaine.[277]

B. Systemic Legislative and Litigation Reforms

With all of that being said, it remains that improvements in fire investigation alone will not get to the root of the problem: a legal system built on finality but relying on science, which is by design always in flux. We have reviewed above the avenues for post-conviction litigation in arson cases in order to show that the solution to helping exonerate persons falsely convicted of arson crimes does not lay in better and more effective litigation strategies. The truth is the 1880 plus people who have been exonerated so far were able to prove their innocence because of the heroic efforts of the innocence project, public defenders, and pro bono private bar lawyers. Day in and day out, in the teeth of seemingly insurmountable procedural bars and constitutional review standards, these lawyers continue to fight on behalf of those who remain unjustly behind bars. But that work, heroic though it may be, cannot fully account for the fundamental flaw in a judicial system that does not permit an innocent person to challenge their conviction effectively, even when we know the science upon which they were convicted is bad.

One possible solution is the Texas post-conviction remedy model, which provides a judicial avenue for such appeals and incorporates the stakeholders on both the science and the legal sides of the issue.[278] Though imperfect, the Texas model involves three components: first, a so-called "junk science writ" within the state habeas corpus statute that permits court entry based on newly discovered evidence of bad science being used for conviction;[279] second, the creation of the

---

275 *See e.g.*, JOHN D. DEHAAN, KIRK'S FIRE INVESTIGATION 543 (6th ed. 2006). *See generally* NFPA 921, *supra* note 7.

276 *See CADA's Position*, supra note 102; NFPA 921, *supra* note 7, at 103.

277 This extraordinary example was provided by Bruce L. Ottley, *Beyond the Crime Laboratory: The Admissibility of Unconfirmed Forensic Evidence in Arson Cases*, 36 NEW ENG. J. CRIM. & CIV. CONFINEMENT 263, 266 (2010).

278 TEX. CODE CRIM. PROC. ANN. art. 11.073 (West 2015).

279 *Id.*

Forensic Science Commission, which is tasked with reviewing cases with forensic science problems;[280] and third, the involvement of the Texas Criminal Justice Integrity Unit in reviewing strengths and weaknesses of the Texas criminal justice system and bringing about reform.[281]

1. Junk Science Writ

The Texas legislature first passed the "Junk Science" Writ, S.B.344, in June 2013.[282] The Writ permits a defendant to bring a habeas corpus claim on the basis of new or changed scientific evidence.[283] Specifically, the Junk Science Writ applies to scientific evidence that was either not available at the time of trial or scientific evidence that contradicts the evidence relied on by the state at trial.[284] A petitioner must allege facts indicating that (1) the relevant scientific evidence is currently available, but was not reasonably ascertainable through due diligence at the time of trial; (2) the new evidence would be admissible under Texas Rules of Evidence if a trial were held on the date of the application; and (3) had the scientific evidence been presented at trial, the defendant would not have been convicted under a preponderance of evidence standard.[285] The scientific evidence must be truly new (not previously discoverable) and the court must consider whether the scientific field has changed since the trial date(s) (for a first time application) or the date of the original application (for a subsequent application).[286]

Significantly—and in contrast to many innocence protection schemes—the right to invoke S.B. 344 is not affected by a confession, acceptance of a guilty plea, or recantation of original testimony.[287] In addition, the new provision

---

280 *About Us*, TEX. FORENSIC SCI. COMM'N, http://www.fsc.texas.gov/about (last visited Nov. 3, 2016). In addition, the above source indicates that the creation of the Forensic Science Commission ("FSC") was in 2005, prior the enactment of the "Junk Science Writ."

281 *Welcome to the Texas Criminal Justice Integrity Unit*, TEX. CRIMINAL JUSTICE INTEGRITY UNIT, http://www.txcourts.gov/cca/texas-criminal-justice-integrity-unit.aspx (last visited Nov. 3, 2016).

282 TEX. CODE CRIM. PROC. ANN. art. 11.073 (West 2016).

283 Linda Rodriguez McRobbie, *In Texas, a New Law Lets Defendants Fight Bad Science*, ATLANTIC (Feb. 28, 2014), http://www.theatlantic.com/national/archive/2014/02/in-texas-a-new-law-lets-defendants-fight-bad-science/283895/.

284 TEX. CODE CRIM. PROC. ANN. art. 11.073(a)(1)–(2) (West 2016).

285 *Id.* art 11.073(b)(1)(A)–(B).

286 *Id.* art 11.073(d)(1)–(2).

287 *See id.*

permits second or successive petitions if the new basis asserted for relief is new or changed scientific evidence.[288]

Since its passage, the Junk Science Writ has been invoked in several high-profile cases in Texas, including the "San Antonio Four" case, the Frances and Dan Keller child abuse case, [289] and the Sonia Cacy arson case.[290] The San Antonio Four case involved four women who were convicted of child sex abuse in 1994.[291] At trial, an expert witness testified that a scar found on one of the children's hymens could only have been caused by sexual abuse.[292] The medical reports even suggested that the sexual abuse was connected to a satanic ritual.[293]

Nine years after the convictions, however, the American Academy of Pediatrics published a study advising that torn or injured hymens do not leave scarring and the expert trial witness retracted her testimony.[294] Despite the outcome of the study, the San Antonio four remained in prison because they did not have a form of relief that would allow them to bring up the new study.[295] With the passage of the Junk Science Writ, the four women had their convictions overturned in 2013 after demonstrating that, using new medical standards, the science behind the expert testimony did not corroborate the alleged victims' claims.[296] The Texas Court of Criminal Appeals held the newly available evidence, a *portion* of which was the unreliable scientific testimony, "unquestionably established" their innocence.[297]

Frances and Dan Keller's convictions for child sexual abuse were also overturned under the Junk Science Writ.[298] Convicted in 1992, the Kellers' conviction centered on the testimony of an ER doctor who had examined one of

---

288 Sabra Thomas, Comment, *Addressing Wrongful Convictions: An Examination of Texas's New Junk Science Writ and Other Measures for Protecting the Innocent*, 52 HOUS. L. REV. 1037, 1051 (2015).

289 *Id.*, at 1051–55.

290 Brantley Hargrove, *Sonia Cacy Found to Be Innocent*, TEX. MONTHLY (June 6, 2016), http://www.texasmonthly.com/the-daily-post/sonia.

291 Thomas, *supra* note 288, at 1052.

292 *Id.*

293 *Id.*

294 *Id.* at 1052–53.

295 *Id.* at 1053.

296 *Id.* The habeas court relied also on the recantations of two of the complaining witnesses.

297 *Ex parte* Kristie Mayhugh, Nos. WR-84,700-1 & WR-84,700-2, 3 (Tex. Crim. App. filed Nov. 23, 2016). The four women were not declared innocent on the basis of the scientific testimony alone; the petitioners also presented recantations from one of the alleged victims, evidence that the alleged victims made their accusations under duress, expert evidence addressing why the alleged victims would come to believe in a crime that never occurred, and expert testimony that the petitioners are not and never were sex offenders. *Id.* at 3–6. In other words, exposure of a forensic discipline as unreliable science, while helpful, was not enough.

298 Thomas, *supra* note 288, at 1054.

the children and testified that lacerations on the girl's hymen could be indications of sexual abuse.[299] The doctor subsequently recanted his testimony, stating that he has since realized that his conclusions (which he believed were accurate during the trial) were not "scientifically or medically valid."[300] The Kellers were able to demonstrate, through their writ of habeas corpus, that scientific standards had changed since the time of the trial and their convictions were vacated.[301]

The third high-profile case involved the 1993 conviction of Sonia Cacy for murdering her uncle by setting him on fire.[302] In 1996, as a part of her punishment retrial, Cacy's attorney enlisted the help of Dr. Hurst to analyze the forensic evidence used to convict her.[303] Dr. Hurst found that the original tests had been misread and that the compounds present merely indicated that the fire burned some plastic, not that an accelerant was used as was testified at trial.[304] Cacy's conviction was affirmed despite this determination.[305] In 1998, Cacy's attorney submitted numerous reports from arson experts and pathologists that concluded the fire was accidental; the Board of Pardon and Paroles released Cacy.[306]

In 2012, Cacy submitted a report to the Texas Court of Criminal Appeals that included a letter from the expert witness who testified regarding the accelerant's presence, admitting that the clothing samples he tested were contaminated.[307] Significantly, the entire case against Cacy had rested on that witness's conclusions and testimony—without that, the medical examiner would not have ruled the death a homicide and the fire investigator would not have testified that the fire was arson.[308] Cacy was exonerated under the Junk Science Writ.[309] On November 2, 2016, Sonia Cacy was declared actually innocent by the Texas Court of Criminal Appeals.[310] The Court determined that she was not competently represented by counsel and the scientific evidence used to convict her was false and unreliable.[311]

---

299 *Id.*

300 *Id.*

301 *Id.*

302 Hargrove, *supra* note 290.

303 *Id.*

304 *Id.*

305 *Id.*

306 *Id.*

307 *Id.*

308 *Id.*

309 *Id.*

310 Brantley Hargrove, *Texas Court of Criminal Appeals Declares Sonia Cacy Actually Innocent*, TEX. MONTHLY (November 3, 2016), http://www.texasmonthly.com/the-daily-post/texas-court-criminal-appeals-declares-sonia-cacy-actually-innocent/.

311 *Id.*

To be sure, the Junk Science Writ goes far in ensuring that a remedy is available to those individuals who have been convicted and witnessed a paradigm shift in the forensic disciplines that played a significant role in their convictions. But it does not go far enough. The problem with this and other post-conviction remedies is that there is too bright a line as to what constitutes "new" evidence—a line that does not correspond to reality. Technically, the Writ is also discretionary, so it does not guarantee that unjust convictions will be overturned. The language in the writ states that the court *may* grant relief if all requirements are satisfied by the defendant—not that the court *shall* or *must* grant relief.[312] This discretionary language causes some to question whether the writ will actually be effective.[313] Incidentally, and perhaps significantly, it is unclear what would be the fate of a case in which an expert employed by the state at trial did not recant his or her own testimony—the cases in which relief has been granted all involve the trial expert's own recantation, rather than the introduction of a new expert.

Finally, the Junk Science Writ still allows faulty or misleading evidence to be introduced at trial.[314] The Writ fails to address the issue of when faulty or skewed evidence is presented. The workability and constitutional significance of *Daubert*, *Frye*, and other similar gateway analyses regarding the admissibility of science or technical expertise must be revaluated, but a full discussion of this recommendation is beyond the scope of this Article.[315]

---

312 TEX. CODE CRIM. PROC. ANN. art 11.073(b) (West 2015).

313 *See* Thomas, *supra* note 288.

314 *Id.* at 1040–44.

315 California, too, has adopted a junk science bill. CAL. PEN. CODE § 1473 (West 2015). California Senate Bill 1058 was approved on September 26, 2014, as a criminal procedure amendment to Section 1473 of the Penal Code. *Governor Signs Leno Bill Helping to Prevent Wrongful Convictions*, SENATOR MARK LENO (Sept. 29, 2015), http://sd11.senate.ca.gov/news/2014-09-29-governor-signs-leno-bill-helping-prevent-wrongful-convictions. S.B. 1058 officially became law on January 1, 2015. *Id.* Sponsored by the California Innocence Project and the Northern California Innocence Project, the bill seeks to address the fact that forensic science testing errors are the second most common factor in wrongful convictions cases in the United States. *Id.* Before the enactment of S.B. 1058, California law allowed for anyone unlawfully imprisoned or restrained to file a writ of habeas corpus for a specified reason that could include if false evidence was introduced at trial that was material or probative of the defendant's guilt or punishment. *See id.* In addition, the previous law gave the judge the ability to reconsider convictions if a material witness recanted their testimony. *See id.* S.B. 1058, however, expands the existing law's definition of false evidence to include expert witness's opinions that have been repudiated by the original expert or have been undermined by advances in science and technology. *Id.* How this provision plays out remains to be seen, but a test case is currently in litigation. *See generally In re* Richards, 371 P.3d 195 (Cal. 2016).

2. Texas Forensic Science Commission

The Texas Forensic Science Commission ("the Commission") was created by House Bill 1068 in May 2005.[316] Its purpose is to investigate cases in which science used at trial is now believed to be false or flawed, and to issue a recommendation that a petitioner can use in an application for a writ of habeas corpus.[317] With the passage of the Junk Science Writ and the Michael Morton Act,[318] which forced Texas prosecutors to open their files to attorneys representing individuals in post-conviction remedy appeals, the Commission has been able to review an increasing number of cases.[319]

The Commission receives complaints from current and former inmates and their families, national advocacy groups, former and current lab employees, and others.[320] As of November 2015, the Commission had received 126 complaints and an additional 17 self-disclosures.[321] The bulk of the Commission's work is currently focused on discipline specific reviews—microscopic hair analysis, DNA mixture interpretation analysis, bite mark

316 *About Us*, *supra* note 280.

317 Michael Hall, *False Impressions*, TEX. MONTHLY (Jan. 2016), http://www.texasmonthly.com/articles/false-impressions/ (last visited Nov. 3, 2016).

318 The Michael Morton Act (S.B. 1611) was signed into law May 16, 2013, and took effect January 1, 2014. *See* TEX. CODE CRIM. PROC. ANN. art. 39.14 (West 2015). Passed by the 83rd Texas Legislature, the Act made changes to Article 39.14 of the Texas Code of Criminal Procedure for the first time since 1965. *See id.* The Act was named after Michael Morton who was exonerated in December 2011 after spending almost 25 years in prison for the murder of his wife. TEX. APPLESEED & TEX. DEF. SERV., TOWARDS MORE TRANSPARENT JUSTICE: THE MICHAEL MORTON ACT'S FIRST YEAR iii (2015), http://texasdefender.org/wp-content/uploads/Towards_More_Transparent_Justice.pdf. The prosecutor in Morton's case knowingly hid evidence that, once tested for DNA, indicated Morton was innocent and another man was the true offender. *Id.* Before the passage of the Act, trial courts were greatly limited in the types of discovery that they could mandate and defendants had no real statutory right to discovery without a court order. *Id.* at ii–iii. However, with the Act, the Texas Legislature ensured that defendants have access to all relevant materials and information favorable to their case in order to best investigate and prepare. *Id.* The State has an obligation to disclose any information favorable to the defense regardless of whether it is exculpatory, impeaching, or mitigating. *Id.* The State's obligation to produce continues after the final conviction and materials must be provided to the defense as soon as is practical after the prosecution receives a request. *Id.* The Act is very broad in favor of the defense, but allows for two exceptions to the production of documents or information—work product or written communications between the prosecutors and other agents of the state. TEX. CODE CRIM. PROC. ANN. art. 39.14(a) (West 2015).

319 TEX. APPLESEED & DEF. SERV., *supra* note 318, at i–iii.

320 TEX. FORENSIC SCI. COMM'N, FOURTH ANNUAL REPORT 11 (2013–2014), http://www.fsc.texas.gov/sites/default/files/documents/files/2015%20FSC%20Annual%20Report%20Posted%20Smaller%20Size.pdf.

321 *Id.* Of the 143 cases, 131 were disposed of either through dismissal by the Commission, investigation and a submitted report, or through a referral to another agency. *Id.*

analysis, and arson case review.[322] The Commission began working closely with the Texas State Fire Marshal's Office on arson cases after the Commission received 17 complaints in April 2011.[323]

The Commission's work is not perfect: Its jurisdiction may be limited to cases that were litigated after its creation (prompting the Commission to issue a no recommendation letter based on lack of jurisdiction in the Sonia Cacy), and complaints involving accredited labs (and, by extension, work that required accreditation).[324] It is still somewhat unclear what limitations, or lack thereof, exist on its work or how proactive a role it will take in preventing the admission of questionable science in the courtroom.

3. Texas Criminal Justice Integrity Unit

The Texas Criminal Justice Integrity Unit is an ad hoc committee established in June 2008.[325] It was tasked with addressing seven core issues centered around higher quality defense counsel for indigent defendants, attorney accountability, compensation for the wrongfully convicted, and reform in terms of evidence handling, interrogations, and eyewitness identifications.[326] The Unit leads education and training reforms to address these issues in conjunction with

---

322 *Id* at 16–22. The Commission formed a Hair Microscopy Review Team in January 2014, and by November 2015, 693 cases were submitted and the team had sought out an additional 120 cases. *Id.* at 18. Additional screening was able to reduce the caseload to 287 and the team has been reviewing and making recommendations. *Id.* The Commission's work with hair microscopy made Texas the first state to do a review of cases that had relied on hair comparison analysis. Hall, *supra* note 317. Since the case that started the Commission's involvement, the Texas Association of Crime Lab Directors has encouraged crime labs to send the Commission cases involving hair analysis. *Id.*

The Commission has been working with various groups to ensure uniform, accurate, and appropriate interpretation of DNA mixtures, and in particular problems with the population statistics that crime labs were using to analyze DNA centered cases. TEX. FORENSIC SCI. COMM'N, *supra* note 320, at 20; Hall, *supra* note 317. In order to do this, the Commission instituted a plan to have each lab submit 10 cases per decade in order to show their protocols and allow for the Commission's experts to study them for issues. Hall, *supra* note 317.

In September 2015, the Commission's Bite Mark Comparison Review Panel had their first meeting and has since been determining the appropriate use, limitations, and role of bite mark evidence and within months had reviewed over 30 cases. TEX. FORENSIC SCI. COMM'N, *supra* note 320, at 21–22.

Due to the expanding responsibilities of the Commission, the legislature, in 2015, doubled their budget to $500,000. Hall, *supra* note 317.

323 TEX. FORENSIC SCI. COMM'N, *supra* note 320, at 20.

324 *Id.*

325 *Welcome to the Texas Criminal Justice Integrity Unity*, *supra* note 281.

326 TEX. CRIMINAL JUSTICE UNIT, ANNUAL REPORT OF ACTIVITIES 3 (Dec. 2009), http://www.txcourts.gov/media/253235/tcjiu-2009-report.pdf.

organizations including the Texas Commission on Law Enforcement Officer Standards and Education ("TCLEOSE").[327]

The Unit has also determined that approximately half of all surveyed judges had received no training on forensic science in the previous year and both required and requested training regarding the standards of reliability of scientific evidence.[328] As a result, the Unit worked to develop forensic science training programs to educate those involved in the criminal justice system.[329] With respect to the use of changing science in wrongful conviction cases, the Unit became one of the first organizations in Texas to educate those who work in the criminal justice system, as well as the public, about developments in fire science and arson investigations.[330]

Despite the affirmative steps the Unit has taken over the years to address their goals, there still exists criticism of the Unit's creation and effectiveness. The Court of Criminal Appeals worked to create the Unit, but the court itself is viewed by some as a part of the problem of wrongful convictions.[331] While the prevailing opinion is that the court is a trailblazer in creating the Unit, the Unit is sometimes viewed as an attempt to improve the court's public image following a few high-profile "embarrassing decisions."[332] Another criticism is that the Unit's topics of focus may be too broad to be truly effective.[333] Mandating training through the Unit addresses a small aspect of the system's larger issues. A more meaningful, targeted approach would be to focus on improving the laws addressing post-conviction procedures and standards and identifying meritorious cases.[334] Thus, whether and how deep its effect on stakeholders in the system will be remains to be seen, as does the possibility of its work having direct effect on cases.

VI. CONCLUSION

"Absolute certainty is not a feature of many credible claims of innocence. Consequently, in the most difficult cases, society must engage in the distribution of risk."[335] The current distribution, which overwhelmingly values

---

327 *Id*. at 6.

328 *Id*.

329 *Id*.

330 *Id*.

331 Jordan Smith, *A Dose of Integrity for Texas Criminal Justice*, AUSTIN CHRON. (June 27, 2008), http://www.austinchronicle.com/news/2008-06-27/640107/.

332 *Id*.

333 *Id*.

334 *Id*.

335 Robert J. Smith, *Recalibrating Constitutional Innocence Protection*, 87 WASH. L. REV. 139, 146 (2012).

finality and comity over justice and innocence, might have made sense when prosecutions and convictions relied primarily on subjective evidence like memory and eyewitness testimony. Memory and credibility can, at least arguably, be vetted primarily by a jury sitting in a courtroom listening to a witness and determining whether the person should be believed. Once the jury issues a verdict in such cases, it becomes challenging for a reviewing court to go back through the cold paper record and determine either on direct appeal or collateral review whether the jury's faith in the witness's credibility was misplaced.

However, a calculus that values comity and finality above all else makes little sense when modern prosecutions rely on an array of forensic evidence that can be independently evaluated and that do not degrade, but is only perfected, over time. Men have been exonerated of rape charges decades after the victim identified them in court because a tiny piece of biological material caught on a stray fabric and dumped in the back of a police storage facility ultimately proved, without a doubt, that they did not commit the crime.[336] The notion that procedural due process, comity, and finality should prevent us from aggressively adopting systemic reforms to make it easier for these wrongfully convicted individuals to use new scientific evidence to prove their innocence seems both morally repugnant and dangerously atavistic.

In a fundamental way, fire investigation, poised between folklore and forensics, perfectly captures the dilemma in which the criminal justice system, also poised between the subjective evidence of the past and the objective science of the future, now finds itself. The men and women introduced at the beginning of the Article were convicted of arson on the basis of testimony we now know has little basis in fact and less connection with science than the juries were led to believe. And yet, the criminal justice system makes it enormously—if not impossibly—difficult for them to prove their innocence. Instead, it demands that individual attorneys go on heroic quests to right the system's wrongs. These attorneys deserve our admiration, but they—and the clients they serve—also deserve a more just system.

336 Alexi Friedman, *Newark Man Jailed for 22 Years in Rape Case Demands DNA Evidence Lost by Police*, STAR-LEDGER (Jan. 3, 2010), http://www.nj.com/news/index.ssf/2010/01/man_jailed_for_sex_assault_dem.html.