



Forensic Science Research Evaluation

A Discussion on the Fundamentals of Research Design and an Evaluation of Available Literature

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Section 2: Interpretation and Assessment

Plenary II. Topic: Scientific Impact of Problematic Literature Title: Pernicious, Pervasive, and Persistent Literature in Fire Investigation

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As a forensic science discipline, fire investigation is unique in the amount of widespread, persistent and problematic literature affecting the beliefs and the behavior of its practitioners. The story begins in 1977, when Boudreau, Kwan and Faragher, working on an Aerospace Corporation grant from the Law Enforcement Assistance Administration (LEAA), conducted a “Survey and Assessment” of arson and arson investigation techniques. In that assessment, the authors listed seven “burn indicators,” but stated, “Although burn indicators are widely used to establish the causes of fires, they have received little or no scientific testing.” They recommended, “that a program of carefully planned scientific experiments be conducted to establish the reliability of currently used burn indicators,” and “a handbook based on the results of the testing program should be prepared for field use by arson investigators.”

Three years later, the “Handbook” called for in the survey and assessment was published by the most respected scientific and engineering body on the planet, the United States National Bureau of Standards (NBS). Unfortunately, the scientific studies recommended in the survey had not been conducted. The NBS editors, Brannigan, Bright, and Jason, were advised by two members of the National Fire Academy staff, and in Chapter 1 they repeated most of the myths that have been used to incorrectly determine that a fire burned faster or hotter than normal. The text refers to “hot” fires and a “rapid buildup of heat,” which is generally interpreted by investigators as indicative of the use of liquid accelerants.

Given the imprimatur tour of such an august body, authors of fire investigation textbooks for the next 20 years felt perfectly comfortable publishing these myths. They were also cited in hundreds, if not thousands of reports where the investigators found arson even though the fires were accidental.

This paper will identify many of the circular references, and illustrate the damage that took so long to undo, although there are still many books in print, even new books, that cite the mythology.

Introduction

This article will explore the development and promulgation of the mythology of arson investigation through published literature. Certainly, there is no reason to believe that anyone ever set out to promulgate something that was not true. It is likely that many myths came about as a result of unwarranted generalizations. For example, an investigator might observe a pattern

of spalling around the remains of a gasoline container and make an association of gasoline with spalling. The next time that spalling is observed, gasoline is inferred.

Some myths arose because of intuitively “obvious deductions.” The notion that gasoline burns hotter than wood is an appealing one, as is the notion that a narrow V-pattern indicates a “rapid fire.” The problem is that the term “rapid” is never defined, thus making it impossible, in many cases, to actually design an experiment to test a particular hypothesis about the significance of a particular indicator. Even when an indicator can be shown by direct evidence to be of no value, resistance to change and a culture of “circular citations” allow the myth to live on. Most of these circular citations happen in fire investigation textbooks. The errors in the peer-reviewed literature, with some exceptions, occur with far less frequency.

Many of the myths were gathered by Boudreau, Kwan and Faragher, working for the Law Enforcement Assistance Administration (LEAA) and published in *Arson and Arson Investigation: Survey and Assessment* (1977).¹ Although the myths were reported with appropriate cautionary language, the cautions were not heeded. Three years later, when the “indicators” were listed by what should have been the ultimate authority, the cautions were lost. No less an authority than the National Bureau of Standards (NBS then—now NIST) published a *Fire Investigation Handbook* (1980), which stated that crazed glass meant rapid heating, shiny alligator blisters meant that a fire burned “faster than normal,” and narrow V’s indicate “fast-developing, hot fires.”² Fire investigators invariably equated these descriptions of the fire as “accelerated using a flammable liquid.”

In the 1980s, one American text after another referred to the NBS publication or to another publication that cited the myths published in the LEAA report. These circular citations continue in books still in print. Interestingly, many of the myths never gained much credibility in the United Kingdom because the major “go to” textbook, Cooke and Ide’s *Principles of Fire Investigation* (1985), either did not repeat the myths, or provided an accurate interpretation of the significance of indicators such as crazing and spalling.³

NFPA 921

In 1985, when the National Fire Protection Association (NFPA) Standards Council became sufficiently concerned about the validity of fire investigations, it appointed a Technical Committee to address the issue. Seven years later, the Committee and NFPA produced the first edition of NFPA 921, *Guide for Fire and Explosion Investigations*. The document listed many of the myths from the LEAA study and the NBS Handbook, and stated why these “indicators” were “misconceptions.” The howls of protest from fire investigation “professionals” were deafening. If what was printed in that document were actually true, it meant that hundreds if not thousands of accidental fires had been wrongly determined to be incendiary fires. No investigator wanted to admit to the unspeakable possibility that they had caused an innocent person to be wrongly convicted, or a family to be wrongly denied their life savings. The profession was in denial, and cited the older publications as support for that denial.

In 1998, the Technical Committee on Fire Investigations, responding to public pressure, removed the word “misconception” from the titles of several paragraphs in the chapter on pattern

development in the optimistic but mistaken belief that previous editions of the document, which was still not accepted in many quarters, had relieved the profession of these misconceptions.

The myths are slowly dying out (or being “*Dauberted*” out), but there are still practitioners who use them today, with disastrous consequences. Apparently, it is more difficult to “unlearn” a myth if one is not equipped with the kind of “baloney detector” that is, one hopes, instilled in students in undergraduate science programs. A recent survey of 217 investigators employed by fire departments revealed that, NFPA 921 notwithstanding, 33% of them believe that crazed glass indicates the presence of an accelerant.⁴

It is distressing to find mythology printed in law enforcement oriented textbooks, but what investigators do with the myths is much worse. Through confident expert testimony, misguided investigators persuade juries that their opinions are correct, and somebody set the fire in question. If such were true, there is often only one possible fire setter. And prior to 1995, it was uncommon for a criminal defendant to have an expert on his or her side to counter the bad science. The NBS Handbook stated, “In general, the function of the fire investigator will be to support prosecution by: ...”⁵

Some examples are presented below.

MI vs. David Lee Gavitt

David Gavitt served 27 years for setting the fire that killed his wife and two children. The prosecutors could find no motive but proceeded based on a finding of “alligatoring” and a deeply flawed chemical analysis, which identified gasoline. Here is the “expert” testimony describing the charring:

“When the gases come out, they dig little trenches for themselves, and all of a sudden the wood begins to look like the back of an alligator. We call this alligatoring. The hotter the fire, the deeper the trenches. Way down inside of the trench soon starts to cool, so that soot turns to charcoal, insulates the inner wood, can’t pyrolyze it anymore.”⁶

PA vs. Han Tak Lee

Daniel Aston, a part time fire investigator, who claimed to have investigated 15,000 fires in 20 years was allowed to render the following testimony:

“A dull alligatoring indicates slow, very slow fire.” Mr. Aston repeated his mistaken belief about what alligatoring indicated again at page 488 (“extremely hot fire, flammable liquid, combustible liquid, once again”), and once more at page 493 (“The severe alligatoring and checking of this char...indicating extremely low fire....flammable, combustible liquid, once again.”)⁷

No flammable liquids were detected in the debris, despite Aston’s precise calculation that more than 60 gallons were involved. Han Tak Lee served 25 years for setting this fire.

AZ vs. Ray Girdler

Ray Girdler served eight years for setting the fire that killed his wife and daughter. He became a suspect when the fire chief noted that he was fully dressed at 2 AM. The Chief did not

manage to learn that Ray had fled his home barefoot and clad only in undershorts, and had been given clothing by his neighbor. The Fire Marshal, David Dale, was able to find plenty of “arson indicators,” including crazed glass. Dale’s testimony, which was rife with other myths, included the following.

Much of this glass was heavily heat-crazed and free of smoke deposit, indicating a rapid buildup of intense heat and close proximity to initial fire, which is consistent with the expected results of a liquid accelerant fire.⁸

PA vs. Paul Camiolo

Mr. Camiolo was held for 10 months in jail awaiting his capital murder trial for setting the fire that killed his elderly parents. One of the investigators for the Commonwealth in his civil rights case relied on crazed glass. George Wert wrote, “A photograph of melted “crazed” glass indicates a very rapid build up of heat in the family room. This indicated a very rapid spread of fire unlike a cigarette fire which would burn much more slowly.”⁹

TX vs. Cameron Todd Willingham

In this, the most famous of all botched arson cases, the Fire Marshal wrote, “The pieces of broken window glass on the ledge of the north windows to the northeast bedroom disclosed a crazed (spiderwebbing) condition. This condition is an indication that the fire burned fast and hot.”¹⁰

Too many to count

The author has participated in more than 50 cases in which uninformed investigators, usually certified fire investigators with many years of experience, testified, or were prepared to testify that arson had occurred, based on the myths they learned from textbooks. There is no way to determine how many citizens have been wrongly imprisoned or wrongly denied the proceeds of an insurance policy as a result.

If one examines the peer-reviewed literature, however, the myths will not be found. It is the near absence of peer review that allows texts to be sold that promulgate the errors. There does not seem to be any obvious solution to the problem. As late as 2013, the tenth edition of *Criminal Investigation*, a \$200 textbook that forms the basis of the curriculum in many criminal justice classrooms, repeated the myths from the 1977 *Survey and Assessment*. Most of the fire investigation texts produced in this century have embraced better science, but Amazon.com still has many of the books from the 1990s available, and the publishers are only too happy to print extra copies if they sense a demand.

The situation is not helped by the fact that public sector salaries for fire investigators are insufficient to attract applicants who have had any kind of science education since high school. Many fire investigators in practice today are unable to name the basic units of energy, or to define a watt. Unless and until governments are willing to spend the money required to hire people who understand the fundamentals of fire science, fire origin and cause determinations will continue to suffer from high rates of error, and all that entails.

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