

# Bridging the Gap: An Application of Social Frameworks Evidence to Shaken Baby Syndrome

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*Ever since the syndrome was first recognized in the 1960s, a diagnosis of shaken baby syndrome (“SBS”) was believed to be pathognomonic of abuse. New data calls into question the accuracy of the diagnosis and its association with nonaccidental death. This data points to alternative causes of brain injuries in infants and small children and casts doubt on the validity of evidence frequently used at trial. This Note explores problems associated with expert testimony in the context of SBS. It argues that despite the ability to accurately present general causation evidence at trial, introduction of specific causation testimony is often premature and unsupported by existing scientific proof. A careful application of John Monahan and Laurens Walker’s social frameworks theory provides the groundwork for new evidentiary techniques in the defense and prosecution of SBS. By limiting expert testimony to that of social frameworks, courts can encourage thorough exploration of pertinent scientific and corroborating evidence, while simultaneously preventing inappropriate specific causation testimony. Finally, this Note compares SBS to other crimes, such as rape and arson, because applying lessons learned from the use of social frameworks evidence in other litigation contexts can help lawyers more accurately and equitably try SBS cases.*

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## INTRODUCTION

Recognizing the need for improvement in the realm of forensic evidence and the law, Congress directed the National Academy of Sciences (“NAS”) to identify the current state of forensic evidence and to “chart an agenda for progress in the forensic science community and its scientific disciplines.”<sup>1</sup> While the resulting 2009 NAS report notes that the last two decades of scientific advancement have contributed to more effective prosecution of criminals as well as the exoneration of innocent individuals, especially in the context of DNA evidence, the report also discusses examples where “substantive information and testimony based on faulty forensic science analyses” contributed to the wrongful conviction of innocent people.<sup>2</sup> These examples illustrate that placing undue weight on evidence produced from imperfect testing, analysis, or testimony leads to the admission of erroneous, unduly biased, or misleading evidence.<sup>3</sup> Despite state and federal case law guiding the use of scientific evidence and expert testimony at trial, problems and

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1. NAT’L ACAD. SCI., STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD xix (2009).

2. *Id.* at 4; see, e.g., Paul C. Giannelli, *Wrongful Convictions and Forensic Science: The Need to Regulate Crime Labs* 166 (Case Western Reserve Univ. Sch. L., Working Paper No. 08-02, 2008), available at <http://ssrn.com/abstract=1083735> (“The most recent study of 200 DNA exonerations found that forensic evidence (present in 57% of the cases) was the second leading type of evidence (after eyewitness identifications at 79%) used in wrongful conviction cases. Pre-DNA serology of blood and semen evidence was the most commonly used forensic technique (79 cases). Next came hair evidence (43 cases), soil comparison (5 cases), DNA tests (3 cases), bite mark evidence (3 cases), fingerprint evidence (2 cases), dog scent identification (2 cases), spectrographic voice evidence (1 case), shoe prints (1 case), and fiber comparison (1 case).”) (citing Brandon L. Garrett, *Judging Innocence*, 108 COLUM. L. REV. 55, 81 (2008)).

3. NAT’L ACAD. SCI., *supra* note 1, at xx, 4.

misunderstandings remain.<sup>4</sup> Judges, as well as defense and prosecution attorneys, often welcome science as a tool in the courtroom. At the same time, practical difficulties arise when increased scientific understanding substantively undermines longstanding legal, social, or scientific assumptions.

This Note explores some of the problems associated with expert testimony in the context of shaken baby syndrome (“SBS”). SBS, also referred to as abusive head trauma,<sup>5</sup> is a category of child abuse that occurs when an abuser—most often a parent, guardian, or caregiver—forcefully shakes an infant or small child, creating a whiplash motion that causes acceleration-deceleration injuries.<sup>6</sup> The shaking motion can cause brain damage or death, often without external evidence of trauma.<sup>7</sup> When first identified, the syndrome was believed to be pathognomonic of SBS, or so characteristic of the syndrome as to lead beyond any doubt

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4. See generally, *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993) (discussing expert testimony and scientific evidence as well as the use of courts and judges as gatekeepers); *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923). Specifically applicable to this Note is the *Daubert* standard, which is the result of three cases decided in the 1990s: *Daubert*, 509 U.S. 579, *General Electric Co. v. Joiner*, 522 U.S. 136 (1997), and *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999). The *Daubert* standard requires an expert’s testimony and opinions to be based on scientific, technical, or other specialized knowledge. *Daubert*, 509 U.S. at 591. To determine if the expert is qualified to testify, the judge must determine whether the testimony “will assist the trier of fact to understand the evidence or to determine a fact in issue.” *Id.* (quoting FED. R. EVID. 702). In addition, scientific testimony must be grounded “in the methods and procedures of science.” *Id.* at 590. More specifically, the *Daubert* standard requires that testimony be “derived by the scientific method” and “supported by appropriate validation.” *Id.* The Court lists several pertinent (although not determinative) factors for consideration, including whether the theories and techniques have been tested; whether they were subjected to peer review and publication; whether they enjoy widespread acceptance in the applicable community; and whether the techniques employed by the expert have a known error rate. *Id.* at 593–98.

5. Recently, there has been some debate regarding use of the name “shaken baby syndrome” to describe these head injuries in infants. For example, in 2009 the American Association of Pediatrics urged that the name SBS be changed to “abusive head trauma.” They explained that “[a]lthough the term [SBS] is well known and has been used for a number of decades, advances in the understanding of the mechanisms and clinical spectrum of injury associated with abusive head trauma compel us to modify our terminology to keep pace with our understanding of pathologic mechanisms.” *Abusive Head Trauma: A New Name for Shaken Baby Syndrome*, AM. ASS’N PEDIATRICS (Apr. 27, 2009, 12:01 AM), <http://www.aap.org/advocacy/releases/may09headtrauma.htm>; see also *Shaken Baby Syndrome Given New Name: Pediatrics Group Urges Use of Diagnostic Term “Abusive Head Trauma,”* MSNBC, Apr. 27, 2009, available at <http://www.msnbc.msn.com/id/30425052/> (“The American Academy of Pediatrics wants doctors to stop using the term ‘shaken baby syndrome’ in favor of something more scientific. The nation’s largest pediatricians’ group recommends ‘abusive head trauma,’ calling it a more comprehensive diagnosis for brain, skull and spinal injuries associated with shaking and other head injuries inflicted on infants. The Academy says the new diagnostic term should be used in medical records and that it may provide more clarity in the courtroom.”). Others have suggested the name “non-accidental head injury” in place of SBS. Robert Minns & Anthony Busuttill, *Patterns of Presentation of the Shaken Baby Syndrome: Four Types of Inflicted Brain Injury Predominate*, 328 BRIT. MED. J. 766, 766 (2004). This Note uses the term SBS for the sake of clarity and familiarity.

6. Edward J. Imwinkelried, *Shaken Baby Syndrome: A Genuine Battle of the Scientific (And Non-Scientific) Experts*, 46 CRIM. L. BULL., Jan.–Feb. 2010, at 156, 159.

7. *Id.* at 161.

to an SBS diagnosis.<sup>8</sup> SBS prosecutions were historically “open and shut” cases in which the adult last in contact with the injured or deceased child was charged.<sup>9</sup> Current medical research and legal scholarship, however, cast doubt on longstanding assumptions about nonaccidental infant death.<sup>10</sup> Recent publications have sparked a heated debate regarding the scientific status of SBS as well as when and how medical experts should be utilized in the courtroom.<sup>11</sup> A growing minority of medical experts now challenge the belief that specific physical symptoms can ever conclusively prove child abuse and argue that a legal analysis of SBS should “start with the premise that there are no pathognomonic markers that specifically define [the syndrome].”<sup>12</sup>

Despite the claim that SBS is a “prosecution paradigm without precedent,” this Note argues that courts have experienced and still confront phenomena similar to abusive head trauma.<sup>13</sup> To identify SBS as wholly unique precludes a comparative analysis that may illuminate courts’ past successes and mistakes when utilizing scientific evidence and expert testimony at trial.<sup>14</sup> At present, publications addressing SBS often fail to place legal questions within this broader evidentiary context. Questioning or criticizing the accuracy of current science can only get us so far. Legal scholars should formulate specific evidentiary rules and techniques limiting expert testimony to that of general causation unless the expert can demonstrate specific causation with a high degree of

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8. Deborah Tuerkheimer, *The Next Innocence Project: Shaken Baby Syndrome and the Criminal Courts*, 87 WASH. U. L. REV. 1, 11 (2009) [hereinafter Tuerkheimer 2009].

9. *Id.* at 18.

10. *See, e.g., id.* at 11–12 (“[T]he scientific underpinnings of SBS have crumbled over the past decade as the medical establishment has deliberately discarded a diagnosis defined by shaking.”).

11. For example, the *New York Times* dedicated much of its February 6, 2011 Sunday magazine to SBS and its current controversies. *See* Emily Bazelon, *Shaken*, N.Y. TIMES, Feb. 6, 2011, at 30 (Magazine) (discussing several individual cases of SBS and the emerging trend of doctors questioning the orthodoxy of shaken baby syndrome, raising the possibility that innocent people have been sent to jail).

12. *See, e.g.,* Richard M. Hirshberg, *Reflections on the Syndrome of the “Shaken Baby,”* 29 MED. & L. 103, 118 (2010) (“[A] definitive understanding of the presumptive biomechanical, neurochemical and pathological mechanisms explaining the findings in the ‘shaken baby’ remain in the realm of ‘unsettled science.’”); *see also* Bazelon, *supra* note 11, at 34 (“We should not be prosecuting and convicting people in shaken-baby cases . . . based on the triad of symptoms, without other evidence of abuse. If the medical community can’t agree about all the conflicting data and research, how is a jury supposed to reach a conclusion that’s beyond a reasonable doubt?” (quoting Keith Findley, a lawyer for the Wisconsin Innocence project)).

13. Tuerkheimer 2009, *supra* note 8, at 1.

14. Indeed, in her 2011 article, Deborah Tuerkheimer acknowledges the potential usefulness of a broader comparative analysis. She states, for example, that “[b]y using SBS as a vehicle for exploring surfacing tensions between science and criminal law, I mean to suggest that seemingly unique features of these cases may, in fact, be shared by other crime prosecution models that we see today, and more importantly, that we will confront in the future.” Deborah Tuerkheimer, *Science-Dependent Prosecution and the Problem of Epistemic Contingency: A Study of Shaken Baby Syndrome*, 62 ALA. L. REV. 513, 550 (2011) [hereinafter Tuerkheimer 2011].

accuracy. A careful application of social frameworks evidence, which uses social science to construct a background context for the facts at issue in a specific case, can help bridge the gap between prosecutors' current ability to demonstrate general causation and their desire to make individualized causal deductions.<sup>15</sup>

This Note is organized in two parts. Part I explores SBS and the debate regarding use of expert medical testimony at trial to prove child abuse and nonaccidental death. We are presently confronted with the problem of how best to prosecute and defend alleged SBS given its current status as an "unsettled science."<sup>16</sup> In an SBS trial, if expert testimony is excluded based on lack of scientific methodology, lack of scientific consensus, or otherwise, there may be insufficient evidence for the prosecution to satisfy its burden of proof. Yet the admission of specific causation testimony may mislead the court as to current scientific understanding or prejudice the jury's interpretation of the facts.<sup>17</sup>

Part II argues that a careful application of John Monahan and Laurens Walker's social frameworks theory can lay the groundwork for new evidentiary techniques in the defense and prosecution of SBS. By limiting expert testimony to that of social frameworks, courts can encourage a thorough exploration of pertinent scientific and corroborating evidence, while at the same time preventing inappropriate specific

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15. See John Monahan & Laurens Walker, *Social Frameworks: A New Use of Social Science in Law*, 73 VA. L. REV. 559, 559 (1987) ("[A] new generic use of social science in law . . . is emerging from recent cases. . . . [E]mpirical information is being offered that incorporates aspects of both of the traditional uses: general research results are used to construct a frame of reference or background context for deciding factual issues crucial to the resolution of a specific case. We call this new use of social science in law the creation of social frameworks.").

16. See Hirshberg, *supra* note 12, at 117-18 ("The main thrust of this paper is to emphasize the obligation of the treating physicians and nurses to exercise extreme caution in designating a child's injuries as 'intentional' when, in fact, a thorough examination of all of the findings might lead to another conclusion and avoid the deeply tragic results of a misdiagnosis. It should also be recognized that a definitive understanding of the presumptive biomechanical, neurochemical and pathological mechanisms explaining the findings in the 'shaken baby' remain in the realm of 'unsettled science.'").

17. See, e.g., *id.* at 116-17 (discussing additional problems with expert testimony in SBS cases); see also *id.* at 104 ("[J]uries are understandably horrified and inflamed by post-mortem and operative photos of infants and children and 'talking points' that exaggerate the forces required to produce a subdural hematoma and retinal hemorrhage. Correlation has been made with some in these cases, to the forces that result from a child being 'thrown 50 feet in an auto accident, falling from a five story window, or being thrown against a wall by an angry adult.'"). It is important to state that this Note does not question the existence of SBS as a serious and tragic medical condition. See Dr. John M. Leventhal, Letter to the Editor, *A Spotlight on Shaken Baby Syndrome*, NEW YORK TIMES, Sept. 21, 2010, at A20 ("As pediatricians who evaluate and care for abused children at Yale-New Haven Children's Hospital, we do not believe there has been a 'shift in scientific consensus' about the syndrome. There is, however, growing scientific evidence that what is now called abusive head trauma is real; that it can be caused by shaking an infant or by shaking and striking the head on a surface; and that it can result in serious brain injury and death."). Science conclusively demonstrates that specific physiological indications are clearly associated with the violent shaking of infants. In other words, causation has been demonstrated at a general level. This Note concentrates on the problems courts face when determining whether violent shaking caused the injuries or death of a particular infant.

causation testimony. This model is particularly applicable in two areas: when a specific scientific methodology has survived *Daubert* analysis, but new scientific findings begin to undermine longstanding conclusions; and when defense and prosecution experts wish to present contradictory evidence that is independently admissible under *Daubert*.<sup>18</sup>

Part II then compares SBS to other areas of the law, including rape and arson prosecution. Although these areas are not intuitively similar to SBS, they possess a range of characteristics rendering them worthy of comparison.<sup>19</sup> What makes these phenomena comparable to SBS is that presentation of scientific evidence is essential in determining whether a crime ever took place. Just as infants can be the unfortunate victims of falls or other accidents, sex can be consensual and fires can have unintentional causes. Further, as in SBS cases, expert testimony in rape and arson trials is often used to formulate both factual and legal conclusions.

Finally, this Note explores the paradigmatic models of eyewitness testimony and gender stereotyping, highlighting the use of social frameworks evidence not as a mechanism to prove specific causation, but

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18. For example, at an SBS trial there may be situations where experts for both the prosecution and the defense put on evidence that, despite sound scientific basis, is contradictory in very significant ways. For example, a longstanding debate regarding SBS is whether shaking alone can cause an infant's death or whether shaking will cause death only in conjunction with impact. See Tuerkheimer 2009, *supra* note 8, at 17. At trial, experts for both the prosecution and the defense may testify that their view can be supported by scientific data. Unlike other scenarios in which the record is so lopsided that the judge would be justified in excluding one side's testimony, "both sides seem to have enough data to qualify their opinions as admissible conclusions under *Daubert* . . . [and] both sides can attack the other's conclusion by pointing to numerous experts who have reached a diametrically opposed conclusion." Edward Imwinkelried, *Methodology vs. Conclusion in Rebuttal Testimony: The Debate over Shaken-Baby Syndrome Exemplifies a Genuine Battle of the Experts Under Daubert*, 32 NAT'L L.J., Aug. 2, 2010, at 9.

19. A range of phenomena including child sexual abuse accommodation syndrome ("CSAAS") and parental alienation syndrome ("PAS") can also illustrate similar logic. This Note highlights SBS, rape trauma syndrome ("RTS"), and arson to illustrate a range of phenomena that, at first glance, do not appear to share categorical similarities. CSAAS, first identified by Roland Summit in 1983, is "used to explain the child's position in the dynamics of sexual victimization." Donna A. Gaffney, *PTSD, RTS, and Child Abuse Accommodation Syndrome: Therapeutic Tools or Fact-Finding Aids* 24 PACE L. REV. 271, 283 (2003). There are no specific behavioral symptoms that can characterize sexual abuse victims. For example, the absence of sexualized behavior does not confirm sexual abuse nor does the existence of sexualized behavior confirm its existence. See Michael E. Lamb, *The Investigation of Child Sexual Abuse: An International, Interdisciplinary Consensus Statement*, 28 FAM. L.Q. 151, 154 (1994).

The term "PAS" was introduced in 1985 by psychiatrist Richard Gardner. See Barbara Jo Fidler & Nicholas Bala, *Children Resisting Postseparation Contact with a Parent: Concepts, Controversies, and Conundrums* 48 FAM. CT. REV. 10, 12 (2010). The syndrome arises primarily in the context of child custody disputes. Similar to CSAAS, there is some debate as to PAS's diagnostic capacity and many writers have abandoned the term "syndrome" when writing about PAS. *Id.* at 13. While some mental health professionals support the validity of PAS as a diagnosis, others argue that this is not clinically valid and argue further that the classification "does not meet the criteria for a syndrome from an evidentiary perspective." *Id.*

as a device used to educate and orient the fact finder.<sup>20</sup> The proper use of evidence to familiarize a judge or jury with current social and scientific trends is invaluable. Rejecting use of expert testimony in an SBS trial altogether may be as adverse to judicial integrity as allowing expert testimony without proper limitations.

### I. SHAKEN BABY SYNDROME: A DIAGNOSIS IN TRANSITION

Since it was first diagnosed in the 1960s, SBS was believed to be pathognomonic of abuse. However, new data calls into question the accuracy of the SBS diagnosis and its association with nonaccidental death.

#### A. HISTORICAL UNDERSTANDING AND CURRENT DEBATE

When prosecuting SBS, presentation of scientific evidence is imperative not only to prove whether a given individual did or did not commit a particular crime, but also to demonstrate whether a crime ever took place.<sup>21</sup> All elements of the crime, including mens rea and actus reus, are proven by scientific testimony.<sup>22</sup> Specifically, “[d]egree of force testimony not only establishes causation, but also the requisite state of mind.”<sup>23</sup> Professor Deborah Tuerkheimer argues that “[i]n its classic formulation, SBS comes as close as one could imagine to a medical diagnosis of murder,” given that prosecutors use scientific evidence to prove not only the mechanism of the injury or death, but the intent to harm as well as the identity of the killer.<sup>24</sup>

When prosecuting child abuse, there are often no witnesses, other than the defendant, available to testify about the events that transpired, and frequently there is little-to-no physical evidence remaining. When physical evidence does remain, it may become so central to an investigation that its importance can become overstated.<sup>25</sup>

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20. See Monahan & Walker, *supra* note 15, at 559. Instead of simply recognizing the existence and legitimacy of social frameworks as a model, this Note emphasizes situations in which expert testimony should be strictly limited to general causation until the science underlying the relevant phenomenon has improved to a threshold degree.

21. This is true in at least two other areas of the law: arson and rape. See *infra* Part II.B.

22. Tuerkheimer 2009, *supra* note 8, at 5.

23. *Id.*

24. *Id.*

25. See, e.g., Tania Simoncelli, *HR 3214 (The “Advancing Justice Through DNA Technology Act of 2003”) and the Tolling of Statutes of Limitations*, ACLU (Nov. 6, 2003), <http://www.aclu.org/technology-and-liberty/hr-3214-advancing-justice-through-dna-technology-act-2003-and-tolling-statute>. Simoncelli discusses the trial and exoneration of Josiah Sutton, who spent nearly five years in jail for a rape he could not have committed. *Id.* Sutton’s conviction rested almost entirely DNA tests that a lab technician mistakenly reported, and testimony at trial by a lab technician who “presented the DNA data to the jury in a misleading way that overstated its value.” *Id.*; see also *FBI: Chemist May Have Botched Evidence*, ABC NEWS, Apr. 28, 2010, <http://abcnews.go.com/WNT/story?id=131076&page=1> (“An investigation says one Oklahoma City Police chemist may have sent several people to prison and

Diagnosis of SBS is based upon the now widely accepted hypothesis that if an adult shakes an infant violently for approximately four or five oscillations during a period of three to ten seconds, the acceleration and deceleration of the brain within the skull can cause severe injury and often death.<sup>26</sup> The infant's heavy head and weak neck muscles permit "the shaking to produce tremendous acceleration and deceleration forces [and the] alternating to-and-fro shaking causes [the back of the skull] to hit the backbone."<sup>27</sup> The rotational movement of the brain in the cranial cavity generates forces strong enough to tear veins in the brain.<sup>28</sup> Victims of SBS are frequently less than one year old and most are less than six months old.<sup>29</sup>

Medical professionals historically identified SBS based on three brain injuries in infants: retinal hemorrhages, subdural hemorrhages, and cerebral edema.<sup>30</sup> Doctors began diagnosing SBS beginning in the early 1970s after medical practitioners identified a pattern among infants admitted to hospitals exhibiting internal injuries.<sup>31</sup> The first was German pediatrician Henry Kempe, who identified co-occurring symptoms in children in the 1960s and concluded that the injuries were likely caused by abuse rather than accidents.<sup>32</sup> A decade later, John Caffey expanded on Kempe's findings and suggested that babies could be seriously injured without external signs of trauma to the body.<sup>33</sup> He took Kempe's research a step further by arguing that the discovery of subdural hematoma and intraocular hemorrhages in an infant was sufficient to determine abuse.<sup>34</sup> Although Caffey outlined a biomechanical understanding of the diagnosis, he also warned that "[c]urrent evidence [was] manifestly incomplete and largely circumstantial."<sup>35</sup> Over time, however, the triad markers came to be understood universally as proof of abuse.<sup>36</sup> Not only did courts repeatedly admit SBS triad markers into

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to executions with evidence that was inconclusive and 'overstated'").

26. Imwinkelried, *supra* note 6, at 159.

27. *Id.* at 159–60.

28. *Id.* at 160.

29. Stephen C. Boos, *ABUSIVE HEAD TRAUMA AS A MEDICAL DIAGNOSIS*, in *ABUSIVE HEAD TRAUMA IN INFANTS AND CHILDREN: A MEDICAL, LEGAL, AND FORENSIC REFERENCE* 49, 50 (Lori Frasier et al. eds., 2006) (explaining that the average age of infants diagnosed with SBS is between three months and ten months, though children up to three years old have been diagnosed).

30. Tuerkheimer 2009, *supra* note 8, at 5. These three injuries are referred to as the "triad" of symptoms of SBS. See Tuerkheimer 2011, *SUPRA* note 14, at 514.

31. Genie Lyons, *Shaken Baby Syndrome: A Questionable Scientific Syndrome and a Dangerous Legal Concept*, 2003 UTAH L. REV. 1109, 1119.

32. *Id.*

33. John Caffey, *The Whiplash Shaken Infant Syndrome: Manual Shaking by the Extremities with Whiplash-Induced Intracranial and Intraocular Bleedings, Linked with Residual Permanent Brain Damage and Mental Retardation*, 54 PEDIATRICS 396, 402 (1974).

34. *Id.*

35. *Id.* at 403.

36. Tuerkheimer 2009, *supra* note 8, at 11.

evidence, but both the legal and scientific communities came to ascribe a “great significance” to such testimony.<sup>37</sup>

When an infant presented with retinal hemorrhages, subdural hemorrhages, and cerebral edema, doctors and other experts concluded that nonaccidental shaking could be the *only* cause of the injuries.<sup>38</sup> Between 1200 and 1400 children in the United States alone sustain head injuries attributed to abuse each year and about 200 cases of SBS are prosecuted annually.<sup>39</sup> There is usually not much dispute that the children were abused in some way, because doctors discover other signs of abuse such as cuts, bruises, burns, fractures, or a history or pattern of these types of injuries.<sup>40</sup> However, in about fifty to seventy-five percent of SBS cases, the only medical evidence presented by the prosecution is the “triad” of internal symptoms.<sup>41</sup>

Recently, doubts have arisen as to the accuracy and scientific validity of evidence used in SBS trials. Most notably, Tuerkheimer has criticized U.S. courts’ current treatment of SBS, stating that the potential risk of wrongful conviction will result in our legal system’s “next innocence project.”<sup>42</sup> Citing a range of medical and legal publications, Tuerkheimer argued that SBS “has been reincarnated to reflect a shifted consensus” and that “until scientific consensus has been achieved, the criminal justice system must find its own solutions to the problem of a diagnosis already morphed and still in transition.”<sup>43</sup>

Studies suggesting that brain bleeding and swelling in infants can be caused by something other than nonaccidental shaking cast doubt on SBS as a pathognomonic condition. For example, short-distance falls may cause fatal head injuries.<sup>44</sup> In addition, a child suffering from a fatal

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37. Imwinkelried, *supra* note 6, at 167.

38. Tuerkheimer 2009, *supra* note 8, at 3–4.

39. Bazelon, *supra* note 11, at 32.

40. *Id.*

41. *Id.*

42. Tuerkheimer 2009, *supra* note 8, at 23. (“In SBS cases, identifying the factually innocent is complicated by two related propositions. First, no crime whatsoever may have occurred, thus eliminating the opportunity to establish someone else’s culpability. Second, at least to date, science has not definitively established an alternative explanation for the injuries associated with SBS. What this means is that a significant number of people convicted in triad-only prosecutions are likely innocent of wrongdoing, but others are not, and we have no way of differentiating between these groups. Accordingly, we may rightly be troubled by the convictions of those whose factual innocence is unproven.”).

43. *Id.* at 16, 58.

44. See John Plunkett, *Fatal Pediatric Head Injuries Caused by Short-Distance Falls*, 22 AM. J. FORENSIC MED. & PATHOLOGY 1, 10 (2001) (reviewing Consumer Product Safety Commission data on playground equipment injuries, and concluding that even short falls by infants can produce hematoma if the fall generates sufficient rotational force). Among other conclusions, Plunkett suggests that “[a] fall from less than 3 meters (10 feet) in an infant or child may cause fatal head injury and may not cause immediate symptoms. . . . A history by the caretaker that the child may have fallen cannot be dismissed.” *Id.*

head injury may experience a lucid interval for more than seventy-two hours before death, challenging the longtime presumption that the perpetrator must be the adult or caretaker who was with the infant immediately before hospitalization or death.<sup>45</sup>

The topic of lucid intervals is one of heated debate. The executive director of the National District Attorneys Association, Scott Burns, responded to Tuerkheimer's 2009 publication by stating that "[s]cientific reality shows that lucid intervals do not occur in children who suffer [these] types of devastating injuries."<sup>46</sup> Burns attacked Tuerkheimer's reliance on a study by Dr. M.G.F. Gilliland, arguing that it "did not document a single reliable case in which a child sustained a fatal head injury and did not immediately become symptomatic."<sup>47</sup> Undeterred, Tuerkheimer reiterates what she views as a real and current controversy surrounding lucid intervals, arguing that "[d]octors now concede the possibility of a lag between injury and neurological manifestation."<sup>48</sup>

Scientists point to other problems with the pathognomonic view of SBS. For example, scientists argue that shaking an infant with an "acceleration-deceleration force . . . [strong enough] to cause retinal hemorrhage and subdural hematoma . . . would necessarily damage the neck and cervical spinal cord or column."<sup>49</sup> Most infants diagnosed with SBS, however, do not present this type of neck or back injury.<sup>50</sup> In addition, Canadian forensic pathologist Evan Matshes recently conducted

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45. Tuerkheimer 2009, *supra* note 8, at 18; *see also* Jan E. Leestma, *Case Analysis of Brain-Injured Admittedly Shaken Infants: 54 Cases*, 26 AM. J. FORENSIC MED. PATHOLOGY 199, 211 (2005) (finding immediate onset of symptoms to be infrequent in "confessed shaking" cases). In emergency medicine, a lucid interval is a temporary improvement in a patient's condition after a traumatic brain injury, after which the condition deteriorates. *See* David Kushner, *Mild Traumatic Brain Injury: Toward Understanding Manifestations and Treatment*, 15 ARCHIVES INTERNAL MED. 158, 1617-24 (1998).

46. Scott Burns, *NDAA Responds to New York Times Shaken Baby Syndrome Editorial*, PROSECUTOR: J. NAT'L DISTRICT ATT'YS ASS'N, July/Aug./Sept. 2010, at 30, 31. Scott Burns's response was submitted to the *New York Times*, but it was not published.

47. Burns, *supra* note 46, at 31 (citing M.G.F. Gilliland, *Interval Duration Between Injury and Severe Symptoms in Nonaccidental Head Trauma in Infants and Young Children*, 43 J. FORENSIC SCI. 723 (1998)).

48. Tuerkheimer 2011, *supra* note 14, at 517 (citing Robert Huntington, Letter, *Symptoms Following Head Injury*, 23 AM. J. FORENSIC MED. & PATHOLOGY 105 (2002) (describing a case study in which an infant manifesting symptoms associated with SBS was observed by hospital personnel in a prolonged lucid state—sixteen hours—before dying).

49. Tuerkheimer 2009, *supra* note 8, at 19-20; *see also* Faris A. Bandak, *Shaken Baby Syndrome: A Biomechanics Analysis of Injury Mechanisms*, 151 FORENSIC SCI. INT'L 71 (2005). Bandak engaged in a "biomechanics analysis of the reported SBS levels of rotational velocity and acceleration of the head for their injury effects on the infant head-neck." *Id.* at 71. He compared SBS data with experimental data on the "structural failure limits of the cervical spine" in animal models and human neonate cadaver models. *Id.* He concluded that an infant head "subjected to the levels of rotational velocity and acceleration called for in the SBS literature" would experience forces exceeding the limits of structural failure of the cervical spine. *Id.*

50. *Id.* at 78.

a peer-reviewed study of 123 autopsies performed on infants in Florida who died from natural or accidental circumstances, or were the victims of homicide, to investigate the likelihood of retinal hemorrhages.<sup>51</sup> Although the children who died as a result of homicide were more likely to have severe retinal hemorrhages than those in the natural or accidental categories, Matshes emphasized that his findings could be explained by factors other than abuse.<sup>52</sup> He stated that “[i]t is simply incorrect to state that severe retinal hemorrhaging is diagnostic of abuse or shaking”<sup>53</sup>

In addition, the inability to create scientifically reliable tests to duplicate SBS is problematic. When studying SBS, researchers are obviously unable to experiment on human subjects, and ethical considerations often prevent experimentation on animals.<sup>54</sup> As a result, experts are unable to present data in court representing precisely how often a particular phenomenon occurs or under what circumstances it will or will not occur in the future. Some scholars therefore argue that individuals cannot or should not be found guilty of child abuse on the basis of subdural hematoma and retinal hemorrhaging alone.<sup>55</sup> Today, the admissibility of expert testimony on SBS varies from one jurisdiction to another.<sup>56</sup>

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51. Bazelon, *supra* note 11, at 36.

52. *Id.* For example, Matshes explained that “the children in the homicide group had isolated head injuries and were more likely to be resuscitated for a period of time” and that therefore, “[i]n the aftermath, they were more likely to develop brain swelling and bleeding disorders that may explain the severe retinal hemorrhaging.” *Id.*

53. *Id.*

54. Tuerkheimer 2009, *supra* note 8, at 20 n.123. *But see* Ayub Ommaya, *Whiplash Injury and Brain Damage: An Experimental Study*, 204 J. AM. MED. ASSOC. 285 (1968). Ommaya’s study is often cited by those defending the SBS diagnosis, although the experiment itself did not specifically test brain injury in human infants, nor did it test the act of shaking. In the experiment, researchers gave anesthesia to rhesus monkeys and placed them in an apparatus designed to mimic a rear end collision. *Id.* at 285–86. After the tests, the researchers killed the monkeys and autopsied their bodies and brains. *Id.* The researchers identified the monkeys who had suffered subdural hematomas to determine the force level at which that type of brain damage would result, and speculated about the extrapolation from the results in monkeys to humans. *Id.* at 287–88.

55. Hirshberg, *supra* note 12, at 116; *see also* Lyons, *supra* note 31, at 1114 (“SBS in its current form should not be accepted by courts as good science. Rather, SBS should be seen as scientifically unproven and insufficient, standing alone, to be the legal basis for proving that a crime has been committed.”); Tuerkheimer 2009, *supra* note 8, at 16 (“With little attention outside of the medical community, universally held tenets have been undermined, leading a segment of the scientific establishment—including some formerly prominent supporters of its validity—to perceive the diagnosis as illegitimate.”).

56. *See, e.g.*, *Hamilton v. Commonwealth*, 293 S.W.3d 413, 420 (Ky. 2009) (“We are mindful that testimony regarding SBS is accepted in other jurisdictions; however, in Kentucky, such testimony has not been recognized as reliable for purposes of judicial notice. As such, it was incumbent upon the Commonwealth to demonstrate the reliability of the scientific methodology underpinning SBS, and it was error for the trial court to judicially notice SBS and shift the burden to prove its unreliability onto Hamilton.”).

In her 2011 publication, Tuerkheimer discusses various trials that were reopened to hear additional evidence regarding SBS as well as situations in which SBS defendants were eventually exonerated of their crimes.<sup>57</sup> In Michigan, for example, a judge sentenced defendant Julie Baumer to ten to fifteen years in prison for violently shaking her nephew and leaving him permanently blind.<sup>58</sup> The same judge then ordered a new trial after hearing postconviction testimony that the infant's injuries were caused by venous sinus thrombosis, a rare form of a stroke caused by a blood clot.<sup>59</sup> The judge ruled that Baumer received ineffective legal representation because her lawyer did not retain an expert to investigate alternative causes of the infant's injury.<sup>60</sup> After Baumer had served four years of her prison sentence, a new jury returned a verdict of not guilty.<sup>61</sup> At trial, expert testimony included six doctors for the defense and three doctors for the prosecution, all of whom testified regarding images of the infant's brain.<sup>62</sup> Jurors explained the jury's decision by citing a lack of evidence of wrongdoing, stating: "We could not tie Julie Baumer to being responsible for those injuries to that child. . . . There was absolute reasonable doubt. [The injury] could have been caused by abuse or it could have been caused by a natural disease process. . . . We concluded we didn't know."<sup>63</sup> Defense counsel stated that the case's outcome might have national ramifications given that it is the first case in which venous sinus thrombosis was shown to mimic SBS.<sup>64</sup>

Similarly, Tuerkheimer points to *State v. Edmunds* as evidence that there has been a significant shift in scientific consensus regarding SBS in recent years.<sup>65</sup> In early 2007, the same judge who had presided over Audrey Edmunds's trial over a decade earlier conducted a five-day evidentiary hearing in support of her motion for a new trial based on newly discovered evidence.<sup>66</sup> The defense experts testified that since the mid-1990s "significant research has undermined the scientific foundations

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57. Tuerkheimer 2011, *supra* note 14, at 530–31.

58. *Id.* at 528 n.124 (citing Christine Ferretti, *Baby Abuse Case Reopens*, DETROIT NEWS, Dec. 9, 2009, at A3).

59. *Id.* (citing Ferretti, *supra* note 58); *see also*, Jan Stam, *Thrombosis of the Cerebral Veins and Sinuses*, 352 NEW ENG. J. MED. 1791–98 (2005). Thrombosis of the cerebral veins and sinuses is a cerebrovascular disorder that most often affects young adults and children, involving blood clots in the brain or in venous sinuses. *Id.* The disorder can be caused by a head injury, obstetrical delivery, or an infection. Symptoms include severe headache, focal abnormalities, or stroke. *Id.*

60. Tuerkheimer 2011, *supra* note 14, at 528 n.124.

61. Jameson Cook, *Aunt Found Not Guilty of First Degree Child Abuse After Spending Four Years in Prison*, MAYCOMB DAILY J., Oct. 15, 2010, available at <http://www.macombdaily.com/articles/2010/10/15/news/doc4cb86fc515b49365300899.txt>.

62. *Id.*

63. *Id.*

64. *Id.*

65. Tuerkheimer 2011, *supra* note 14, at 527 (citing *State v. Edmunds*, 746 N.W.2d 590 (Wis. Ct. App. 2008)).

66. Tuerkheimer 2009, *supra* note 8, at 48.

for SBS, creating substantial challenges to matters that were nearly universally accepted in the medical community at the time of Edmunds's trial.<sup>67</sup> The defense experts stated further that at the time of the original trial they, too, would have testified that shaking was the cause of death, yet an "evolution in science" changed their opinion about the likely causes of the injuries.<sup>68</sup> Although the trial court denied the motion, the appellate court reversed the trial court's decision, concluding that there was a reasonable likelihood that a different result would be reached at a new trial based on new evidence.<sup>69</sup> Edmunds was granted a new trial and all charges against her were dismissed.<sup>70</sup>

Relying primarily on the *Edmunds* decision, recent defendants have also made efforts to challenge SBS convictions. In Wisconsin, a trial judge granted defendant Quentin J. Louis a new trial, stating:

[A]s to a new trial in the interest of justice, the principal issue was whether any shaking done by Louis was the cause of [the baby's] death. However, the jury did not hear that [SBS] is subject to debate in the medical community, that [the baby] may have died of a chronic subdural hematoma over a period of months and that for brain injuries to occur, there must also be evidence of neck injuries. At trial, the State assertively and repetitively relied upon the tenants [sic] of [SBS] to prove its case. To uphold the integrity of our system of justice, a jury should be afforded the opportunity to hear and evaluate this other evidence.<sup>71</sup>

The court's synopsis of the trial evidence was indeed a "virtual primer in the SBS prosecution paradigm,"<sup>72</sup> given that, in no uncertain terms, the court stated that specific causation was demonstrated at trial:

What the jury heard at trial from the medical experts was that from [the baby's] injuries alone, they could determine that (1) the only explanation for [the baby's] injuries was that she was shaken, (2) since SBS did not allow for a lucid interval and [the baby] was in Louis's care at the time she went limp, he must have shaken her and, (3) that Louis's shaking therefore was the cause [of the baby's] death.<sup>73</sup>

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67. Brief of Defendant-Appellant at 4–5, *State v. Edmunds*, 746 N.W.2d 590 (Wis. Ct. App. 2008) (No. 2007AP000933).

68. Tuerkheimer 2009, *supra* note 8, at 48–49.

69. *Edmunds*, 746 N.W.2d at 599 (“[A]t trial, the State was able to easily overcome Edmunds's argument that she did not cause [the baby's] injuries by pointing out that the jury would have to disbelieve the medical experts in order to have a reasonable doubt as to Edmunds's guilt. Now, a jury would be faced with competing credible medical opinions in determining whether there is a reasonable doubt as to Edmunds's guilt. Thus, we conclude that the record establishes that there is reasonable probability that a jury, looking at both the new medical testimony and the old medical testimony, would have a reasonable doubt as to Edmunds's guilt.”).

70. Tuerkheimer 2009, *supra* note 8, at 51.

71. *State v. Louis*, No. 05-CF-193, slip op. at 12 (Wis. Cir. Ct. Aug. 12, 2009), available at <http://scribd.com/doc/22325225/State-of-Wisconsin-v-Quentin-J-Louis>.

72. Tuerkheimer 2011, *supra* note 14, at 530.

73. *Id.* at 531 (citing *Louis*, No. 05-CF-193, slip op. at 11).

In his brief, Louis quoted a range of medical evidence to demonstrate that the “medical/legal debate over Shaken Baby Syndrome rages on.”<sup>74</sup>

#### B. PROVING SBS GENERALLY AND SPECIFICALLY

SBS, like virtually all scientific evidence, has two components, which the courts typically refer to as “general causation” and “specific causation.”<sup>75</sup> In a prosecution for SBS, the research indicating that intentional shaking of an infant will lead to certain physical effects is general, speaking to the scientific knowledge of the phenomenon in question, and largely independent of the case at hand. If general causation has been adequately demonstrated, there remains the question of whether a particular case is an instance of that general phenomenon. This is specific causation.<sup>76</sup> Whereas general causation asks whether the cause-and-effect relationship of interest (for example, does shaking an infant lead to certain physical effects) is adequately demonstrated by the research, specific causation asks whether the effects observed in this case are attributable to the cause that is the focus of the prosecution.<sup>77</sup>

SBS, as a subject of scientific research, presents the issues of general and specific causation in the same way they arise in virtually all medical causation cases. For example, if the question in a civil case was whether the plaintiff developed lung cancer as a result of being exposed to asbestos while working for the defendant, proof would be needed to demonstrate both that asbestos is a likely cause of lung cancer and that the plaintiff’s lung cancer was probably caused by asbestos exposure.<sup>78</sup> The research studies on asbestos and lung cancer would be introduced to demonstrate the general causation claim. Proving the specific causation claim is much less straightforward and involves demonstrating first that asbestos could have caused the lung cancer, and second that something other than asbestos probably did not cause it.<sup>79</sup> Determining specific causation requires many complex steps, including an exposure and health

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74. Brief of Defendant-Respondent, *State v. Louis* (Wis. Cir. Ct. Aug. 3, 2010) (No. 2009AP2502-CR), 2010 WL 3267969, at \*8.

75. David Faigman, *Judges as “Amateur Scientists,”* 86 B.U. L. REV. 1207, 1220 (2006).

76. *Id.* (“Courts have recognized some of the difficulties inherent in employing general scientific data to reach conclusions about specific cases. . . . Not all science is engaged in describing cause and effect relationships, however, so ‘general causation’ and ‘specific causation’ are subcategories of what might be better termed ‘general propositions’ and ‘specific applications.’ Sometimes general scientific propositions will be stated in terms of causation, but very often they will be associational, technical, or descriptive. Specific application refers to the determination of whether a particular case is an instance, use, or example of general propositions that are supported by adequate research.”)

77. Michael D. Green et al., *Reference Guide on Epidemiology*, in FEDERAL JUDICIAL CENTER, REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 333, 381–82 (2d ed. 2000).

78. David L. Faigman, *Evidentiary Incommensurability: A Preliminary Exploration of the Problem of Reasoning from General Scientific Data to Individualized Legal Decision-Making*, 75 BROOK. L. REV. 1115, 1121 (2010).

79. Green et al., *supra* note 77, at 384–86.

assessment, consideration of alternative causes, and finally the simple question of “whether all the pieces of the puzzle fit together or not.”<sup>80</sup> To some extent, the last step is a judgment call.<sup>81</sup>

There is little question that existing research supports the general causation element of SBS, in that certain physical effects occur as a consequence of violent shaking. The important and largely unexplored issue in these cases is whether there is a sufficient scientific basis to allow an expert to go further and testify regarding specific causation. The ordinary methodology used in medical causation cases to determine whether a particular case is an instance of a general phenomenon is “differential etiology.”<sup>82</sup>

At the outset, it is important to emphasize that the task concerns identifying the underlying cause of the effect in question, and thus courts’ use of the term “differential diagnosis” is sometimes misleading and incorrect.<sup>83</sup> Differential diagnosis involves the identification of an illness or behavioral condition experienced by an individual.<sup>84</sup> For example, if a patient presents herself to the doctor with symptoms of coughing, the treating physician will attempt to “rule out” certain diagnoses, such as lung cancer or asthma, based on medical history, environment, and so forth, in order to eventually arrive at the correct diagnosis.<sup>85</sup> Unlike differential diagnosis, differential etiology involves the identification of the cause or causes of the illness or behavioral condition.<sup>86</sup>

In practice, the techniques are often confused and have been applied erroneously. Courts have a tendency to equate a doctor’s training and experience in differential diagnosis with the ability to make conclusions based on differential etiology:

Although courts often say that physicians are well-trained in the process of differential diagnosis and that they devote considerable attention in medical school to learning clinical reasoning, in point of fact the training is in the process of *deducing disease* based on a set of

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80. Thomas S. Schrager, *Science of Toxicology, General and Specific Causation*, CAMBRIDGE TOXICOLOGY GROUP, <http://www.toxicologysource.com/scitox/generalandspecif.html> (last visited July 4, 2011); see also Joseph Sanders, *Science Law and the Expert Witness*, 72 LAW & CONTEMP. PROBS. 63, 85 (2009) (“Limits there may be, but undoubtedly the need for closure produces some shrinkage of the ‘don’t know’ domain in the courtroom. Nowhere is this more evident than with respect to questions of specific causation. . . . [L]arge parts of science focus on general principles, or at least on aggregate findings, while courts are nearly always concerned, among other things, with facts about the individual case.”).

81. Schrager, *supra* note 80.

82. Faigman, *supra* note 78, at 1131.

83. *Id.*

84. *Id.*

85. *Id.* at 1130–31.

86. *Id.* at 1131.

symptoms and laboratory tests. This is a very different task than deducing the *cause* of a disease.<sup>87</sup>

For example, in *Wynacht v. Beckman Instruments, Inc.*, a products liability case arising from exposure to chemicals in wastewater released from a lab, the judge held that the clinical treating physician was not qualified to testify about medical causation.<sup>88</sup> The court stated:

[T]here is a fundamental distinction between [the expert's] ability to render a medical diagnosis based on clinical experience and her ability to render an opinion on causation of [the plaintiff's] injuries. . . . [T]he Court does not question, that [the expert] is an experienced physician, qualified to diagnose medical conditions and treat patients. The ability to diagnose medical conditions is not remotely the same, however, as the ability to deduce, delineate, and describe, in a scientifically reliable manner, the causes of these medical conditions.<sup>89</sup>

According to Joseph Hirshberg, the Emeritus Chairman of Neurosurgery at St. Joseph Hospital in Houston, Texas, SBS is a diagnosis of exclusion and should never be made casually.<sup>90</sup> Hirshberg further argues that even when differential diagnosis techniques are generally appropriate, “there may be a lack of knowledge of the controversies and debates concerning the dynamic aspects of the neuropathology and biomechanics” even among experienced specialists in these fields.<sup>91</sup> It follows that expert testimony by those who are unqualified to deduce causation might result in the indictment or conviction of innocent people.

Toxic tort cases provide good examples of situations in which experts attempt to use general causation evidence to make deductions related to specific causation.<sup>92</sup> Experts may claim that they have undertaken a differential diagnosis when in actuality they have engaged in a differential etiology, attempting to consider and eliminate plausible causes of the disease.<sup>93</sup> Professor David Bernstein argues that “the substance of such testimony usually amounts to this: in the absence of

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87. Sanders, *supra* note 80, at 85.

88. *Wynacht v. Beckman Instruments, Inc.*, 113 F. Supp. 2d 1205, 1206 (E.D. Tenn. 2000).

89. *Id.* at 1209.

90. Hirshberg, *supra* note 12, at 116.

91. *Id.* at 105.

92. See David E. Bernstein, *Expert Witnesses, Adversarial Bias, and the (Partial) Failure of the Daubert Revolution*, 93 IOWA L. REV. 451, 464 (2008) (“[P]laintiffs typically rely on evidence that is directly suggestive (at most) only of general causation. For example, a plaintiff in a typical toxic tort case may rely on any or all of the following types of evidence: animal studies usually involving much higher relative exposure to the substance at issue; laboratory studies on cells; anecdotal case reports; the temporal relationship between exposure and disease; regulatory actions by the government; analogy to similar substances known to cause disease; studies on humans involving much higher exposure levels; and epidemiological studies that are too preliminary to be of much value (if, for example, their sample size is too small), or are suggestive but not statistically significant, or have a relative risk well below two.”).

93. *Id.*

some other known causal mechanism, I speculate that the product or substance at issue in this case caused the plaintiff's injury."<sup>94</sup> As Bernstein's observation suggests, inferences about specific causation are often little more than speculation or guesswork. At best, they are judgments being made on the basis of the totality of the evidence.<sup>95</sup>

If judgment does indeed play a role, it raises the question: who, if anyone, is qualified to offer an opinion whether an individual is legally responsible for an infant's death? In the case of SBS, it should be the task of the judge or jury, not the expert, to determine if the evidence admitted at trial is sufficient to support a finding of specific causation. Experts may be more qualified to testify regarding current scientific data, medical examinations, or medical screenings, but, given current controversies, it is not appropriate for experts to make "conclusions" as to whether a given child was subject to shaking. "[S]ometimes even very good science will not demonstrably improve the accuracy of individual decision-making, though it might nonetheless be relevant and admissible because it provides the triers of fact with contextual information that will help them understand other evidence in the case."<sup>96</sup>

Professor David Faigman identifies the misuse of specific causation in the courts and urges increased interest and investigation on the topic by the legal community.<sup>97</sup> As Faigman states,

The primary area in which courts have considered this matter is in medical causation cases where they distinguish routinely between "general causation" and "specific causation." Courts and legal scholars have not, however, engaged in a careful study of the details and intricacies associated with this matter across the wide spectrum of cases in which it presents itself. In addition, although the courts are passingly familiar with the problem of evidentiary incommensurability, they naturally approach the subject from their own need for information, with little appreciation for how and whether scientists can produce this information. Courts frequently demand empirical answers despite scientists' inability to provide them.<sup>98</sup>

In general, "the law is interested not simply in whether a particular variable causes a particular effect, but, ultimately, in whether a particular variable did cause the effect."<sup>99</sup> Although science can sometimes prove

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94. *Id.*

95. *See id.*

96. Faigman, *supra* note 78, at 1119.

97. *Id.* at 1117-18 ("My objective, however, is somewhat unusual. It is a call to arms. I do not aim to resolve the incommensurability paradox, but rather to ring the fire-bell.")

98. *Id.* at 1117 (footnote omitted).

99. *Id.* at 1120. Faigman argues:

A basic difference in perspective between science and the law is that science studies individuals in order to make statements about populations, while the law studies populations in order to make statements about individuals. It does not necessarily follow that a scientist who can validly describe a general phenomenon also has the wherewithal to say whether an individual case is an instance of that general phenomenon.

specific causation, in most circumstances scientific certainty can only determine general causation.<sup>100</sup> This reality becomes important when the verdict of a case rests on the prosecution's ability to prove *both* general and specific causation.<sup>101</sup>

Historically, some courts have allowed experts to testify as to specific causation in SBS trials. In *State v. Leibhart*, for example, the Nebraska Supreme Court concluded that the trial court did not abuse its discretion when it admitted expert testimony regarding SBS.<sup>102</sup> At trial, an expert witness testified about features of SBS and explained the syndrome in terms of general causation.<sup>103</sup> The court overruled the objection made by defense counsel, who argued that there was "not sufficient foundation to give us an opinion."<sup>104</sup> The expert went on to testify regarding specific causation, stating that

Emily's injury was consistent with shaken baby syndrome . . . that there was no other explanation for her injury . . . [and that] the injuries could not have been caused by a bump on the head or a fall from a couch and that the shaking that resulted in her injury could not have been done by another child.<sup>105</sup>

When questioned regarding the adequacy of scientific testing of SBS, the trial judge responded by explaining that there are limits as to

*Id.* at 1135–36.

100. For example, Koplik's spots are pathognomonic of measles, and a diagnosis of asbestosis or mesothelioma is thought to be pathognomonic of exposure to toxic chemicals. *Id.* at 1120. Faigman states: "The strongest version of a path-specific relationship would be the unusual situation where a cause and an effect are uniquely associated, such that the cause always produces the effect and the effect is always attributable to the cause." *Id.*

101. See, e.g., Monahan & Walker, *supra* note 15, at 574 (citing *State v. Saldana*, 324 N.W.2d 227 (Minn. 1982)). In *Saldana*, the trial court incorrectly substituted a finding of general causation for the necessary finding of specific causation. Here "the defendant was convicted of rape at a trial at which an expert witness for the prosecution compared the complainant's reactions to the reactions of groups of women who had been raped." *Id.* The Minnesota Supreme Court, in overturning the conviction, stated that the jury "must not decide this case on the basis of how most people react to rape. . . . Rather, the jury must decide what happened in *this case*." *Saldana*, 324 N.W.2d at 230.

102. *State v. Leibhart*, 662 N.W.2d 618, 628 (Neb. 2003).

103. *Id.* at 624.

104. *Id.*

105. *Id.* (footnote omitted). The court summarized the testimony of Dr. Shaffer, who treated the child:

Emily had suffered shaken baby syndrome. Shaffer elaborated by testifying that the injury indicated that Emily had been shaken in a manner such that the brain was shaken back and forth and that small blood vessels and nerve cells in the brain were torn. He testified that there was diffuse brain injury that was indicative of shaking, as opposed to trauma from something such as a fall or a hit to the head which would result in a more localized injury. Shaffer also testified that the shaking need not be forceful or for a long period of time for the shaking to cause the injury from which Emily suffered. Shaffer testified that he saw no signs of external injuries or bruising or evidence of blunt trauma on the outside of Emily's head. Shaffer finally testified that symptoms of shaken baby syndrome would have manifested themselves within minutes of the precipitating event.

*Id.* at 623–24 (footnotes omitted).

realistic scientific understanding, and stated that SBS has “been clinically tested as the best it can.”<sup>106</sup> The Nebraska Supreme Court concluded that “with respect to specific causation, the district court did not abuse its discretion in concluding that such reasoning or methodology properly could be applied to the facts in issue in this case.”<sup>107</sup>

SBS presents the courts with a challenging situation, given that the syndrome, by definition, presupposes a cause. A determination that an infant suffered from SBS implies that the injury was caused by abuse, even when the analysis appropriately utilizes differential diagnosis. Indeed, the name “shaken baby syndrome” alone is indicative of crime and suggests a finding of specific causation. Given that the underlying definition of SBS is harm or death caused by nonaccidental shaking, an expert testifying that SBS symptoms are present, for example, implies the existence of physical abuse.<sup>108</sup> There has been a recent debate, in fact, regarding the name given to SBS.<sup>109</sup> The name describes the occurrence of several of brain injuries occurring concurrently, yet by using the word “syndrome” the name implies both a medical and legal conclusion.<sup>110</sup> Although some medical practitioners have sought to change the name of the diagnosis, many of the proposed alternatives are imperfect and still presuppose abuse.<sup>111</sup>

## II. SOCIAL FRAMEWORKS: LIMITING EXPERT TESTIMONY

Our legal system faces a challenge in responding to the current controversy regarding SBS and other “science-dependent”<sup>112</sup> prosecutions. Because science is an ever-evolving field, some argue that “[a]fter some period of lagging behind, the law will eventually recalibrate itself in response to the failed science movement and resolve the tension which has propelled the system forward.”<sup>113</sup> This future-minded focus, however, does not provide immediately applicable answers.

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106. *Id.* at 627.

107. *Id.* at 628.

108. *See, e.g.*, Molly Gena, *Shaken Baby Syndrome: Medical Uncertainty Casts Doubt on Convictions*, 2007 WIS. L. REV. 701, 726 (“[D]octors should not use the term ‘shaken baby syndrome’ in courts at all, because it conjures up an image of abuse and violence and merely represents a legal confusion that attempts to describe what happened to the baby.”).

109. *See supra* note 5.

110. *See supra* note 5.

111. *See supra* note 5.

112. “Science-dependent prosecution” is a term adopted by Tuerkheimer “to convey the degree to which any given prosecution relies on the claims of science for its success.” *See* Tuerkheimer 2011, *supra* note 14, at 551 n.305.

113. *Id.* at 550.

## A. SOCIAL SCIENCE AND THE LAW

Monahan and Walker's 1987 article, *Social Frameworks*, identified a "new generic use of social science in law."<sup>114</sup> Based on Kenneth Davis's model, the article differentiated between legislative and adjudicative facts.<sup>115</sup> According to Davis, facts concerning the immediate parties to a lawsuit are adjudicative facts and facts relating to the determination of law and policy are legislative facts.<sup>116</sup> Monahan and Walker, however, posited that there exists a range of situations where social science evidence in the courtroom cannot be classified as either legislative or adjudicative.<sup>117</sup> As an example, Monahan and Walker cite *State v. Myers*, where the defendant was found guilty of criminal sexual conduct involving a minor.<sup>118</sup> The prosecution presented, over the objection of defense counsel, a social science expert witness to testify to the behavioral traits "typically observed" in abused children.<sup>119</sup> On appeal, the defense claimed that this amounted to a reversible error, but the Minnesota Supreme Court disagreed, holding that "[b]ackground data providing a relevant insight into the puzzling aspects of the child's conduct and demeanor which the jury could not otherwise bring to its evaluation of her credibility is helpful and appropriate."<sup>120</sup>

In another article, Monahan and Walker highlight the applicability of social frameworks evidence in cases involving eyewitness identification, risk assessments of violence, Battered Woman Syndrome, and Rape Trauma Syndrome ("RTS").<sup>121</sup> Monahan and Walker's analysis also reflects upon the question of when, if ever, an expert can testify by way of "linking the general research to the specific facts of the case before the jury."<sup>122</sup> As discussed above, courts have taken different approaches as to when "general" social science research should be linked to a specific individual.<sup>123</sup> Today, social frameworks have become a common and important part of trials, particularly employment

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114. Monahan & Walker, *supra* note 15, at 559.

115. *Id.* at 563 (citing Kenneth Culp Davis, *An Approach to Problems of Evidence in the Administrative Process*, 55 HARV. L. REV. 364, 402-03 (1942)).

116. Davis, *supra* note 115, at 402-03.

117. Monahan & Walker, *supra* note 15, at 559.

118. *Id.* at 567 (citing *State v. Myers*, 359 N.W.2d 604 (Minn. 1984)).

119. *Id.*

120. *State v. Myers*, 359 N.W.2d 610 (Minn. 1984).

121. Monahan & Walker, *supra* note 15, at 563. RTS is a subset of post-traumatic stress disorder, describing a cluster of psychological and physical signs, symptoms, and reactions that are common to rape victims. The symptoms may occur during, immediately following, and for months or years after a rape. See Ann Wolbert Burgess & Lynda Lytle Holmstrom, *Rape Trauma Syndrome*, 131 AM. J. PSYCHIATRY 981, 982 (1974) ("Rape trauma syndrome is the acute phase and long term reorganization process that occurs as a result of forcible rape or attempted forcible rape.").

122. Monahan et al., *Contextual Evidence of Gender Discrimination: The Ascendance of "Social Frameworks"*, 94 VA. L. REV. 1715, 1732-33 (2008).

123. See *supra* Part I.B.

discrimination class actions where discrimination suits are often based upon issues of stereotyping or prejudice.<sup>124</sup> In these trials, testimony regarding general research provides context to the judge or jury so they can better interpret case-specific data and make causal deductions when appropriate.<sup>125</sup>

Monahan and Walker provide the example of *International Healthcare Exchange v. Global Healthcare Exchange*, in which a trial court allowed an expert to apply general principles from gender stereotyping literature to the facts of a specific case.<sup>126</sup> The expert witness, after presenting a range of general social data regarding stereotyping in the workplace, opined that the plaintiff's work assignments and termination were the product of stereotyping.<sup>127</sup> Yet other courts have barred experts from presenting social frameworks and then linking the research findings to issues in the specific case on trial.<sup>128</sup> For instance, in a 1991 opinion, the Ninth Circuit determined that the trial court did not abuse its discretion in admitting an epidemiologist's general testimony on Hmong culture, but precluded the expert from giving "his opinion regarding the specifics of [the] case, such as whether there was a rape or why these particular plaintiffs did not report the rape."<sup>129</sup>

In applying social frameworks to the phenomenon of SBS, "experts . . . should be prohibited from providing any linkage to the case at hand" and instead leave the application of general research findings to the factfinder.<sup>130</sup> Until science reaches a higher degree of certainty, it should be the judge or jury that is tasked with applying social frameworks to the facts of each case. Of course, doctors should be able to testify regarding test results or medical examinations of a victim. The expert does have a superior degree of knowledge to explain existing science and epidemiological studies and this kind of testimony can assist the judge or jury. Educating and training trial counsel and expert

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124. Monahan et al., *supra* note 122, at 1716.

125. *See id.* at 1716–17.

126. *Id.* at 1733 (citing *Int'l Healthcare Exch., Inc. v. Global Healthcare Exch., L.L.C.*, 470 F. Supp. 2d 345, 355 (S.D.N.Y. 2007)).

127. *Id.* (quoting *Int'l Healthcare Exch.*, 470 F. Supp. 2d at 355).

128. *Id.*

129. Monahan et al., *supra* note 122, at 1733 n.52 (quoting *Dang Vang v. Toyed*, 944 F.2d 476, 481–82 (9th Cir. 1991)).

130. *Id.* at 1734 ("The paradigmatic linkage question is presented when an expert testifies about general research—that is, research that did not involve the parties in the case before the court and then proposes to apply that research to the specific case at hand. Any such linkage offered by the expert, however, would violate Federal Rule of Evidence 702, which requires, as a threshold matter, that testimony offered by an expert be based on 'sufficient facts or data.' No field of social science of which we are aware permits its experts to speculate that a general finding, derived from group averages or ecological correlations, applies to each member of the group or applies to one specific group member but not to another." (footnotes omitted)).

witnesses regarding the theory and application of social frameworks evidence will result in more thorough investigations and unbiased litigation. Expertise should be grounded in the ability to understand and explain science, not in the ability to testify as to the guilt or innocence of a particular party. Limiting testimony to social frameworks will move factfinding away from the expert witness and back into the hands of the judge or jury.

#### B. PLACING SBS IN CONTEXT: RAPE AND ARSON PROSECUTION

Determining when and in what form SBS evidence should be admitted at trial is a twofold issue. First, there must be a determination that the evidence presented at trial fits into the pertinent legal framework. To be introduced at trial at all, evidence must be legally relevant.<sup>131</sup> Second, once relevance is established, the question becomes how that evidence should be presented at trial and if its presentation should be limited to social frameworks. Exploring similar paradigms helps illustrate the usefulness of social frameworks at trial as well as the challenges this technique inherently presents. In both rape and arson trials, courts encounter a plethora of evidence that fits seamlessly into the relevant legal framework, but must nonetheless be limited in its introduction at trial.

Like SBS, rape and arson provide examples of offenses for which science cannot always provide definitive mechanisms to prove specific causation.<sup>132</sup> Again, it is worth comparing these phenomena with SBS because in each, scientific evidence is essential in determining whether a crime ever took place. In each of these contexts, evidence is utilized to demonstrate a defendant's underlying intentions as well as to show that the alleged actions were indeed criminal.

In rape prosecutions, because victims often wait to report the crime, DNA evidence or physical injuries disappear before the initiation of a criminal investigation and certainly before trial.<sup>133</sup> Other than statements made by the alleged victim or perpetrator, the only available evidence remaining may be a doctor's evaluation of a complainant's psychological well-being, often including a diagnosis of post-traumatic stress disorder

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131. See FED. R. EVID. 402.

132. See Tuerkheimer 2011, *supra* note 14, at 553 (“[T]he crime of arson has striking parallels to SBS. In fire investigations, as in forensic medicine, ‘mistakes can lead to the belief that there is a crime when none was committed.’ Here, too, expert testimony establishes the actus reus (the damaging of real property by means of fire or explosive). The requisite mens rea (typically knowledge) is proven by the fire investigator’s conclusion that the fire was purposely set.” (footnotes omitted) (quoting Maurice Possley, *Arson Myths Fuel Errors*, CHICAGO TRIBUNE, Oct. 18, 2004)); see also *supra* note 19.

133. See Laura M. Monroe et al., *The Experience of Sexual Assault: Findings from a Statewide Victim Needs Assessment*, 20 J. INTERPERSONAL VIOLENCE 767, 770 (2005) (finding that more than half of the victims at nineteen sexual assault centers in Maryland waited years before disclosing rape, especially when a family member perpetrated the assault).

or RTS.<sup>134</sup> The medical diagnosis, it follows, often becomes a central component of arguments made by both defense and prosecution counsel at trial. In cases involving arson, evidence literally may be incinerated, or, when evidence is available, fire investigators may rely heavily upon burn patterns and other physical remnants despite their questionable scientific validity.<sup>135</sup>

Use of testimonial evidence in the courtroom to prove the occurrence of SBS, rape, and arson has followed a similar trajectory. This path can be understood in two stages. First, there was a historical period in which evidence presented in court was believed sufficient to prove both general and specific causation.<sup>136</sup> Second, as scientific techniques evolved, legal and scientific experts began to criticize and openly challenge long-held assumptions about the strength of causal evidence as well as the science that underlies each phenomenon.<sup>137</sup>

Research into the effects of both SBS and rape is made difficult by a shared inability to use human subjects in experimentation.<sup>138</sup> Researchers may recruit participants from rape crisis centers, yet those who seek help are only a minority of sexual assault victims and therefore do not form a representative sample.<sup>139</sup> In addition, it is not easy to evaluate the behavior of individuals prior to victimization, because it is impossible to predict in advance who will later become the target of a violent crime.<sup>140</sup> Finally, other than through direct testimony by a victim, it is difficult to ascertain whether post-rape symptoms were present before the occurrence of the traumatic event in question.<sup>141</sup>

Unlike SBS and rape, arson is an area in which investigators have made a sizeable attempt to recreate fires for experimental and research purposes.<sup>142</sup> Indeed, during the 1970s and 1980s, the Center for Fire Research<sup>143</sup> conducted hundreds of test burns to characterize the behavior of fire up to the point of “flashover.”<sup>144</sup> Yet of the hundreds of fires conducted during this time period, none were examined *after*

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134. *Id.*

135. *See infra* note 170 and accompanying text.

136. Tuerkheimer 2009, *supra* note 8, at 11.

137. Tuerkheimer 2009, *supra* note 8, at 11–12.

138. 2 DAVID L. FAIGMAN ET AL., MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY 446 (2009–2010 ed.).

139. *Id.*

140. *Id.* at 447.

141. *Id.*

142. 5 DAVID L. FAIGMAN ET AL., MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY 206 (2009–2010 ed.).

143. The Center for Fire Research is now known as the National Institute of Standards and Technology.

144. 5 FAIGMAN ET AL., *supra* note 142, at 206 (“Flashover is a transitional phase in a compartment fire when the temperature rises to a level sufficient to cause ignition of all exposed combustible items in the compartment.”).

flashover, so almost no evidence is available to demonstrate what types of burn patterns are common after flashover is achieved.<sup>145</sup> Today, test burns continue to take place on a regular basis in order to familiarize investigators with the range and characteristics of burn patterns but the “vast majority of burn exercises conducted over the years have been performed with . . . limited goals in mind . . . [which] has resulted in many trainees getting a one-sided view of fire investigation.”<sup>146</sup>

Similar to the use of burn patterns to tell the story of a fire, the behavior of an alleged victim can be relevant in a rape trial. A diagnosis of RTS was historically introduced in court to prove the occurrence of a sexual assault and continues to be admitted at trial today to explain a victim’s seemingly counterintuitive behavior or to demonstrate lack of consent on the part of a complainant.<sup>147</sup> An expert, for example, might testify that the delayed reporting of rape by an individual should not be used to undermine the credibility of her testimony. Although RTS was never understood to be pathognomonic of sexual assault, expert testimony has been used for several purposes, including diagnosing an alleged victim as having a psychological disorder; demonstrating or undermining the credibility of the alleged victim; or, in limited circumstances, directly demonstrating to the court that *rape* is the underlying cause of psychological symptoms.<sup>148</sup> In the case of RTS, experts now understand “the syndrome [to be] so broad and accommodate[] such a wide spectrum of behaviors that it ‘would seem to leave the only commonality among the victims their self-expressed report of rape.’”<sup>149</sup> In fact, critics argue that if the diagnosis of RTS were to be subject to analysis under *Daubert*, it might be excluded for lack of

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145. *Id.* at 212.

146. *Id.* Burn exercises are often conducted for the purpose of familiarizing investigators with what an ignitable liquid burn pattern looks like or to provide extinguishment exercises for firefighters. *Id.* at 212–13. Two types of test burns are usually employed, the first attempting to test one or more basic hypotheses about a fire, and the other attempting to reconstruct a particular fire. The second type, however, requires enormous expenses often ranging from \$10,000 to \$100,000 and thus is only conducted when a fire has caused multiple deaths or when the damages are in the millions of dollars. *Id.* at 213.

147. Courts have at times attempted to draw a distinction between prohibiting testimony about RTS to prove that a rape occurred, and allowing it for the limited purpose of proving that the alleged victim did not consent. *See infra* note 158 and accompanying text. This distinction can be challenging, however, given that lack of consent is a principal element of rape.

148. *See, e.g.,* State v. McQuillen, 689 P.2d 822, 829 (Kan. 1984) (allowing an expert to testify to the victim’s diagnosis but not allowing testimony that a victim was, in fact, raped); *see also* State v. Allewalt, 517 A.2d 741, 751–52 (Md. 1986) (allowing testimony that rape was the underlying trauma of the victim’s post-traumatic stress disorder, on the theory that testimony about post-traumatic stress disorder is medical testimony).

149. Keith Findley, *Innocents at Risk: Adversary Imbalance, Forensic Science, and the Search for Truth*, 38 SETON HALL L. REV. 893, 920 (2008) (quoting Janet C. Hoefel, *The Gender Gap: Revealing Inequities in Admission of Social Science Evidence in Criminal Cases*, 24 U. ARK. LITTLE ROCK L. REV. 41, 51 (2001)).

scientific validity.<sup>150</sup> Indeed, most courts do not substantively analyze the reliability or scientific basis of the syndrome, but instead rationalize admission of evidence by relying on former court decisions that accept the syndrome as scientifically valid.<sup>151</sup> Despite criticisms, almost all jurisdictions admit expert testimony on RTS into evidence.<sup>152</sup>

Despite its relevance at trial, a victim's behavior or a doctor's clinical diagnosis of that behavior is usually not enough to convict or exonerate a defendant. To some extent, social frameworks' limitations have been applied in cases of rape to limit an expert's ability to testify regarding actual guilt or innocence. Although the courts do not always refer to "social frameworks" explicitly, in practice the methods utilized closely resemble the Monahan and Walker model. Specifically, it has been suggested that expert testimony in rape cases falls into one of five categories: (1) fact-based testimony about the general behavior of rape victims, (2) fact-based testimony about the general diagnostic criteria of RTS, (3) testimony about victim's behavior or symptomatology, (4) opinion testimony about the consistency of the victim's behavior or symptoms with RTS, and (5) opinion testimony that the victim suffers from RTS.<sup>153</sup> The first two categories represent *generalized* expert testimony because they permit discussion of victims' responses generally but forbid explicit references to the complainant, while the remaining three categories represent *particularized* expert testimony because they address whether the complainant in the case can be diagnosed as exhibiting symptoms of RTS.<sup>154</sup>

Some states allow an explicit reference to the syndrome, while others limit references to common symptoms without a reference to the diagnosis directly. Under the latter framework, courts allow experts to discuss victim responses as well as expert testimony regarding common rape-victim responses.<sup>155</sup> Some suggest that generalized testimony is a "wise framework" because it allows the expert witness to explain that what might seem like an unusual response may actually be quite common for a victim.<sup>156</sup> Moreover, generalized testimony prevents opening the "door to a potential bias jurors may have against the well-established but

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150. Janet C. Hoefel, *The Gender Gap: Revealing Inequities in Admission of Social Science Evidence in Criminal Cases*, 24 U. ARK. LITTLE ROCK L. REV. 41, 55 (2001).

151. *Id.*

152. Christopher Emrich, *The Playboy Defense in Philadelphia: How Pennsylvania Continues to Thwart Fair and Effective Sexual Assault Prosecutions by Refusing to Admit Expert Testimony About Rape Trauma Syndrome*, 6 RUTGERS J.L. & PUB. POL'Y 891, 893 (2009) (noting that Pennsylvania is the only state that forbids prosecutors from calling experts to testify regarding a victim's behavior).

153. Karla Fischer, *Defining the Boundaries of Admissible Expert Psychological Testimony on Rape Trauma Syndrome*, 1989 U. ILL. L. REV. 691, 713-24.

154. Emrich, *supra* note 152, at 923.

155. *Id.* at 923

156. *Id.* at 918.

‘softer’ science of psychology.”<sup>157</sup> Some states, like Arizona, allow an expert witness to testify about RTS only to aid the factfinder in determining if there was consent, not in the determination of whether a rape occurred.<sup>158</sup> “The expert is also prevented from testifying specifically about the complainant, essentially leaving the jury to decide whether such a diagnosis is appropriate.”<sup>159</sup>

Like SBS and RTS evidence, fire investigators in arson cases historically searched for and testified about physical evidence they considered to be conclusive indications of intentional fires. Evidence of concrete spalling, for example, was introduced at trial as decisive evidence that a fire was started by incendiary means.<sup>160</sup> In addition, the discovery of “crazed glass” was relied upon to indicate the existence of “a fast spreading fire.”<sup>161</sup>

While the remnants of a fire may provide important and relevant clues regarding the possibility of an incendiary origin, the science underlying arson prosecution has been criticized. For example, the first edition of the National Fire Protection Association’s (“NFPA”) *Guide for Fire and Explosion Investigations* was published in 1992 and has since been revised multiple times, most recently in 2008.<sup>162</sup> Between 1998 and 2001, numerous proposals to change the guidelines for fire investigation were submitted.<sup>163</sup> The publication highlights tension between “old guard” fire investigators, who are confident in their reliance on experience and instinct to make causal conclusions, and newer proponents of the scientific method.<sup>164</sup> For the most part, science has prevailed: the *Guide* has been revised in substance and format to reflect

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157. *Id.*

158. *Id.* at 918–19. There is an inherent problem in this distinction, given that a necessary element in the definition of rape is lack of consent.

159. *Id.*

160. 5 FAIGMAN ET AL., *supra* note 142, at 159. Spalling concrete is concrete that breaks up, flakes, or becomes pitted. *Id.* at 236. This can be caused by exposure to high temperatures as well as the natural process of weathering, corrosion, continual friction, or a direct impact with another object. *Id.*

161. *Id.* at 159–60. Crazed glass, a spider web-like pattern in glass, has been described in forensic textbooks as a key indicator that a fire had burned “fast and hot,” meaning that it had been fuelled by a liquid accelerant, causing the glass to fracture. *Id.* at 235–36.

Older reports demonstrate that nonscientific data was relied upon to demonstrate the origin of intentional fires. See, e.g., RAYMOND L. STRAETER & C.C. CRAWFORD, *TECHNIQUES OF ARSON INVESTIGATION* 110–13 (1955). For example, Straeter and Crawford’s practice guide instructs fire investigators on identifying “female arsonists.” *Id.* at 110. The publication includes a section titled, “How to discover whether a female caused the fire,” explaining: “[the] fairly recognizable traits or techniques in common [among female fire starters] . . . [are that they] tend to be a bit ‘childish,’ ‘silly,’ hasty, poorly planned . . . [and are] often spur-of-the-moment, impulsive, and ill-considered jobs.” *Id.* at 110–11. While these assumptions are no longer controlling, they illustrate the tremendous shift in understanding that has taken place the last fifty years despite remaining controversies.

162. NFPA, *NFPA 921: GUIDE FOR EXPLOSION AND FIRE INVESTIGATIONS* (2008).

163. 5 FAIGMAN ET AL., *supra* note 142, at 220.

164. *Id.* at 220–21.

the scientific method, and define and demand deductive and inductive reasoning.<sup>165</sup> The guidelines state specifically that “[t]he systematic approach recommended [for a fire investigation] is that of the scientific method, which is used in the physical sciences.”<sup>166</sup> In addition, there has been a rise in *Daubert* challenges to fire investigators who do not follow the NFPA recommendations, and the *Daubert* rulings often cite directly to the NFPA.<sup>167</sup> Given that arson is neither a physical nor psychological condition, factors do not exist to “diagnose” a fire.<sup>168</sup> Instead, fire investigators rely on a range of “indicators” that are interpreted by experts. In a fire investigation, the effect is known (a fire) and science is offered in court to demonstrate the cause of that effect (an accidental or incendiary source).<sup>169</sup> These techniques and indicators, however, “have long been plagued by ‘ill-defined, flexible, and explicitly subjective criterion’ based upon unproven assumptions, exaggerated claims, and deficient research, testing, and measuring techniques.”<sup>170</sup> Limiting evidence would severely restrain the prosecution’s ability to build its case, but allowing testimony regarding fire indicators runs the risk of allowing the admission of “junk science.”<sup>171</sup>

In both rape and arson prosecutions, available evidence is relevant to the event in question, yet much of the evidence should be limited to social science frameworks in order to prevent experts from making unsupported causal deductions. Whether in the form of an epidemiological study or an expert’s testimony about past experience, testimony can inform the judge or jury as to the current understanding in the relevant field, but it should not be used by experts to make inappropriate causal deductions.

### C. EYEWITNESS IDENTIFICATION AND GENDER STEREOTYPING

Eyewitness identification provides a paradigmatic model for the use of social frameworks evidence at trial, because it has come under scrutiny in the recent years due to the use of DNA evidence to exonerate individuals convicted primarily due to eyewitness testimony.<sup>172</sup>

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165. *Id.* at 221.

166. NFPA, *supra* note 162, at 18.

167. 5 FAIGMAN ET AL., *supra* note 142, at 222. According to Faigman, “[i]t is the misinterpretation of fire effects and fire patterns (as opposed to incorrect procedures) that account for most of the incorrect determinations of fire origins and cases.” *Id.*

168. *Id.* at 235.

169. Faigman, *supra* note 78, at 1122.

170. Thomas R. May, *Fire Pattern Analysis, Junk Science, Old Wives Tales, and Ipse Dixit: Emerging Forensic 3D Imaging Technologies to the Rescue?*, 16 RICH. J.L. & TECH., no. 4, 2010, at 1, 2 (quoting EDWARD J. IMWINKELREID, *THE METHODS OF ATTACKING SCIENTIFIC EVIDENCE* 204 (4th ed. 2004)); see also David L. Faigman, *Anecdotal Forensics, Phrenology, and Other Abject Lessons from the History of Science*, 59 HASTINGS L.J. 979, 979–80 (2008).

171. See May, *supra* note 170, at 2 n.7.

172. CBS News *Eyewitness: How Accurate Is Visual Memory?* (television broadcast Mar. 8, 2009).

Most experts at trial are utilized to *explain* the problems associated with eyewitness identification. For example, researchers have concluded that certain factors, including cross-racial identifications, the presence of a weapon, or use of leading questions by interviewers can undermine the accuracy of identifications.<sup>173</sup> Given that few contest the existence of these types of cognitive biases, the core question regarding eyewitness identification testimony is not whether the testimony is scientifically accurate, but whether an expert witness will indeed assist the trier of fact at trial. Some critics argue that a judge or jury may be able to evaluate the accuracy of eyewitness identifications *without* the help of an expert.<sup>174</sup> Regardless, experts have been utilized frequently to explain some of the problems inherent in eyewitness testimony.<sup>175</sup>

Eyewitness identification, in essence, provides a “mirror image” example of the dilemma of causal expert testimony discussed above. Unlike SBS, where the *effect* is known and the *cause* is of unknown origin, in eyewitness identification “the causal side of the equation is the independent variable, which is more or less known or assumed to be present in the case. The focus, therefore, is principally on what effect this causal variable has had.”<sup>176</sup> In such cases, courts have followed a pattern whereby expert testimony is admitted as evidence in an effort to provide a social framework for the phenomenon in question. Experts share sociological or psychological studies with the factfinders without making causal conclusions as to whether the eyewitness identification was contaminated by an intervening variable. Specific causation cannot be demonstrated with a high degree of accuracy, given that studies demonstrate that eyewitness testimony often yields inaccurate results. Yet even with these epidemiological studies, it is almost impossible to demonstrate whether in a given instance a particular witness misidentified another individual.<sup>177</sup>

In *People v. Mooney*, for example, the judge reflected upon the usefulness of social frameworks, explaining that courts have repeatedly upheld admission of expert testimony to clarify an area in which jurors have general, but not detailed understanding.<sup>178</sup> Similarly, the judge in

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173. Faigman, *supra* note 78, at 1122.

174. See generally Christian Sheehan, *Making the Jurors the “Experts”: The Case for Eyewitness Identification Jury Instructions*, 52 B.C. L. REV. 651 (2011).

175. See 2 FAIGMAN ET AL., *supra* note 138, at 497.

176. Faigman, *supra* note 78, at 1122 (“Hence, if the witness is white and the perpetrator is black, the empirical crux of the matter concerns what effect this causal variable has on the accuracy of the identification.”).

177. See, e.g., Jennifer L. Mnookin, *Fingerprint Evidence in an Age of DNA Profiling*, 67 BROOK. L. REV. 13, 17 (2001). “[E]yewitness testimony [is] a notoriously unreliable form of evidence. People are all distinct from one another in observable ways; therefore the theoretical error rate of eyewitness identification is zero, though in practice observers may frequently make errors.” *Id.* at 60.

178. *People v. Mooney*, 559 N.E.2d 1274, 1277 (N.Y. 1990).

*United States v. Hines* explained her view regarding the educational use of expert testimony:

Nor do I agree that this testimony somehow usurps the function of the jury. The function of the expert here is not to say to the jury—“you should believe or not believe the eyewitness.” . . . All that the expert does is provide the jury with more information with which the jury can then make a more informed decision. And only the expert can do so. In the absence of an expert, a defense lawyer, for example, may try to argue that cross racial identifications are more problematic than identifications between members of the same race, or that stress may undermine accuracy, but his voice necessarily lacks the authority of the scientific studies [the defendant’s expert] cited.<sup>179</sup>

Courts have debated the usefulness of testimony about factors that generally interfere with eyewitness accuracy, versus testimony about the witness in question. Although some courts claim that experts unfamiliar with the specific facts of the case would not be useful, other courts disagree, stating that the generality of the expert’s statements are less invasive of the jury’s province.<sup>180</sup> When presenting social framework evidence on eyewitness identification, Monahan and Walker argue that “the expert can testify on general research that cross-racial identification is, on average, worse than same-race identification.”<sup>181</sup> However, it would not be appropriate for the expert to testify that the particular witness misidentified a particular defendant of a different race.<sup>182</sup> Indeed,

Testimony of this kind would improperly treat findings drawn from aggregate data as if they revealed constant effects across individuals and settings, and would ignore the potential confounding and moderating variables that were statistically or experimentally controlled in the research settings but that could not be controlled in the specific case where the behavior in question occurred.<sup>183</sup>

Like eyewitness identification, Faigman argues that the primary value of work on gender stereotyping is to educate the factfinder regarding the nature of the phenomenon, rather than to offer an opinion about the specific case, defendant, or witness before the court.<sup>184</sup> The Ninth Circuit’s decision in *Dukes v. Wal-Mart Stores, Inc.* provides a relevant, although undoubtedly controversial, example of social frameworks evidence at the trial level.<sup>185</sup> In the class action suit alleging

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179. *United States v. Hines*, 55 F. Supp. 2d 62, 72 (D. Mass. 1999).

180. See 2 FAIGMAN ET AL., *supra* note 138, at 495–96.

181. Monahan et al., *supra* note 122, at 1734–35.

182. *Id.* at 1735.

183. *Id.* at 1735–36 (footnote omitted).

184. See, e.g., *Hnot v. Willis Grp. Holdings Ltd.*, No. 01 CIV 6558 GEL., 2007 WL 1599154, at \*2 (S.D.N.Y. June 1, 2007) (“Such testimony can be valuable in giving a jury context within which to evaluate the particular evidence relating to the workplaces at issue here.”).

185. See *Dukes v. Wal-Mart Stores, Inc.*, 603 F.3d 571 (9th Cir. 2010), *rev’d*, *Wal-Mart Stores, Inc. v. Dukes*, No. 10-277 (U.S. June 20, 2011). The Ninth’s Circuit’s discussion remains relevant despite the Supreme Court’s reversal.

that Wal-Mart engaged in a long-term pattern of gender discrimination, the plaintiffs presented evidence from Dr. William Bielby, a sociologist, to interpret and explain facts suggesting that Wal-Mart had a corporate culture that included gender stereotyping.<sup>186</sup> In his expert report, Bielby explicitly stated that he was utilizing social frameworks evidence:

I have also relied upon a large body of social research on organizational policy and practice and on workplace bias. Social research conducted across many decades has generated considerable knowledge about what generates and sustains workplace inequalities. That same research, either directly or by implication, points to the kinds of workplace policies and practices that are likely to minimize bias. . . . Thus, the scientific evidence about gender bias, stereotypes, and the structure and dynamics of gender inequality in organizations that I rely upon has substantial external validity and provides a sound basis for analyzing the policies and practices of Wal-Mart. My method is to look at distinctive features of the firm's policies and practices and to evaluate them against what social science research shows to be factors that create and sustain bias and those that minimize bias. In litigation contexts, this method of analysis is known as "social framework analysis."<sup>187</sup>

Interestingly, Monahan and Walker, who stress the importance and usefulness of social frameworks evidence, have critiqued the method by which Bielby used social science evidence at trial and argue that he made improper causal statements connecting general findings to the specific case at hand.<sup>188</sup> They note that "Dr. Bielby . . . opined that Wal-Mart's employment practices 'contribute to disparities between men and women in their compensation and career trajectories at the company.'"<sup>189</sup> Therefore, they argue, Bielby did much more than make "general assessments" about discrimination in the workplace.<sup>190</sup> Indeed, Monahan and Walker state further that Bielby "opined that gender was a causal factor in some unspecified percentage of all personnel decisions at all Wal-Mart facilities across the USA for all of the class period, without testing for the effect of candidate gender on any specific personnel decision."<sup>191</sup>

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186. Expert Report of William T. Bielby, Ph.D., *Dukes v. Wal-Mart Stores, Inc.*, 222 F.R.D. 137 (N.D. Cal. 2004), available at <http://www.walmartclass.com/staticdata/reports/r3.html> (last visited July 4, 2011).

187. *Id.* at 3.

188. John Monahan et al., *The Limits of Social Framework Evidence*, 8 L. PROBABILITY & RISK 307 (2009).

189. *Id.* (citing Bielby, *supra* note 186, at 25) (emphasis omitted).

190. Monahan et al., *supra* note 188, at 312.

191. *Id.* Monahan argues that expert witnesses should be permitted to link general research findings to the facts of a specific case: "Of course, this does not mean that the social framework expert can necessarily offer any expert judgment about specific causation; the question of whether discrimination in fact led to the denial of specific promotions of women at Wal-Mart, for example, is one that will ultimately be answered by the fact finder. . . . [T]he risk presented by testimony from a social scientist on the specific causation question is that the assessment that is called for may well fall

Despite these criticisms, it is apparent that social frameworks have been useful in a range of litigation contexts. Building upon the application of social frameworks in areas such as eyewitness testimony, lawyers will progress in their ability to successfully and equitably try SBS cases.

#### CONCLUSION

The problem of SBS places the courts at an important crossroads. If evidence exists that is relevant at trial, but runs the risk of misinforming the judge or jury as to its specific causal relevance, courts must adopt rules that limit expert testimony to that of social frameworks. This paradigm is of particular importance as courts attempt to balance the need to convict individuals guilty of crimes such as child abuse with the need to protect the innocent.

It is useful to place SBS within a broader evidentiary context and evaluate scientific and social science phenomena that share some of the unique characteristics of SBS. The areas of rape and arson discussed here can provide a starting point to inspire the continued exploration social frameworks evidence in the courtroom.

Science continues to advance, and we may indeed reach a point in the future when we can prove phenomena like SBS with specific causation testimony. Yet we must be careful not to attempt to do so until we can establish more accurate diagnostic criteria.<sup>192</sup> To bridge that gap, there exists a special set of circumstances where evidence is worthy of admission if limited to a general social science context.

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outside of the proffered expert's field of expertise. What the social framework expert *is* doing is looking at the policies and practices operating in a workplace more generally and identifying the ways in which they may limit or permit operation of stereotype and bias. To say that some forms of 'linkage'—the link to specific causation—are beyond the scope of a social scientist's expertise is very different from saying that a social scientist is engaging in impermissible 'linkage' whenever he or she evaluates specific workplace policies and practices in light of current social science literature." *Id.* (quoting Melissa Hart & Paul Segunda, *A Matter of Context: Social Framework Evidence in Employment Discrimination Class Actions*, 78 *FORDHAM L. REV.* 37, 55 (2009)).

192. For example, Matshes is now working on a study that will examine whether infants with subdural and retinal hemorrhaging might have certain neck injuries that have gone undetected. See Bazelon, *supra* note 11, at 36. Matshes and his team are conducting autopsies of the entire cervical spinal column, an area not usually examined in SBS cases. *Id.* He hopes that this might help identify an additional diagnosis tool to help distinguish which babies have actually been abused versus those that may have subdural and retinal bleeding from other causes. *Id.* at 36–37.

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