

HOW EXPERTS HAVE DOMINATED THE NEUROSCIENCE NARRATIVE IN CRIMINAL CASES FOR TWELVE DECADES: A WARNING FOR THE FUTURE

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ABSTRACT

Phineas Gage, the man who survived impalement by a rod through his head in 1848, is considered “one of the great medical curiosities of all time.” While expert accounts of Gage’s post-accident personality changes are often wildly damning and distorted, recent research shows that Gage mostly thrived, despite his trauma. Studying past cases such as Gage’s helps us imagine—and prepare for—a future of law and neuroscience in which scientific debates over the brain’s functions remain fiery, and experts divisively control how we characterize brain-injured defendants.

This Article examines how experts have long dominated the neuroscience narrative in U.S. criminal cases, especially insanity cases, which often concern a defendant’s brain damage or abnormality. To support these arguments, this Article reports the results of my original Twelve-Decade Neuroscience Study (“The Study”) examining the criminal justice system’s use of the insanity defense in all criminal cases—totaling 8,358—which involved neuroscientific evidence from 1900 to 2020.

The Study shows that, despite the increasing influx of neuroscientific evidence and its purportedly greater objectivity into the criminal justice system, experts still sway how that evidence is cast when it concerns a defendant claiming insanity. The Study’s results also explain how experts for the defense and the prosecution vary in their approaches. For example, defense experts employ narratives to emphasize the impact of neuroscientific evidence on a defendant’s brain and behavior for purposes of mitigating punishment. In contrast, prosecutors increasingly use accusations of malingering in their attempts to win cases—claiming that defendants are lying about their disorders. This Article concludes that in years hence, courts may expect seemingly more impartial information derived from neuroscientific tests to incorporate more accurate and precise indicators of the human mental condition. Whether the field of neuroscience will succeed in that quest will be one more question for the future and the experts who still may try to shape it.

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INTRODUCTION

*“We know the future only by the past we project into it.”*¹

On September 13, 1848, Phineas Gage’s brain made history.² Gage, a construction foreman, was working with his crew on a railway line in Cavendish, Vermont, when, in minutes, his life changed forever.³ Without warning, an explosion erupted, propelling a three-and-a-half-foot iron rod straight through Gage’s head.⁴ The rod’s trajectory was bizarre and inconceivable: it entered the left side of Gage’s face behind his eye and then soared out of the top of his skull.⁵ Landing thirty feet away, the rod was “smeared with brains and blood.”⁶ Yet, what followed this tragedy would be most improbable of all. The twenty-five-year-old Gage survived.⁷ Immediately after his injury, Gage was conscious, alert, speaking to those around him, and walking, mostly unassisted.⁸ He would live for another eleven years.⁹

The Gage case is considered “one of the great medical curiosities of all time,”¹⁰ a staple in primary textbooks in neuroscience and psychology, and a frequent citation in articles and reports.¹¹ The

1. JOHN LEWIS GADDIS, *THE LANDSCAPE OF HISTORY: HOW HISTORIANS MAP THE PAST* 3 (2002) (emphasis added).

2. See generally MALCOLM MACMILLAN, *AN ODD KIND OF FAME: STORIES OF PHINEAS GAGE* (2000) (detailing the life and legacy of Phineas Gage).

3. *Id.* at 368-80 (discussing how Gage acquired his fame).

4. See J. M. Harlow, Letter to the Editor, *Passage of an Iron Rod Through the Head*, 39 *BOS. MED. & SURGICAL J.* 389, 389-93 (1848) [hereinafter *Harlow 1848*]; John M. Harlow, *Recovery from the Passage of an Iron Bar Through the Head*, 2 *PUBL’NS MASS. MED. SOC’Y* 329, 330-31 (1868) [hereinafter *Harlow 1868*].

5. See *Harlow 1848*, *supra* note 4, at 389-93; *Harlow 1868*, *supra* note 4, at 330-31.

6. Henry J. Bigelow, *Dr. Harlow’s Case of Recovery from the Passage of an Iron Bar Through the Head*, 20 *AM. J. MED. SCIS.* 13, 14 (Isaac Hays ed., 1850); *Harlow 1848*, *supra* note 4, at 390 (indicating the rod was “smeared with brain”).

7. See *Harlow 1848*, *supra* note 4, at 389-90.

8. See *id.*

9. See MACMILLAN, *supra* note 2, at 370.

10. Malcolm Macmillan, *Inhibition and Phineas Gage: Repression and Sigmund Freud*, 6 *NEURO-PSYCHOANALYSIS* 181, 182 (2004).

11. See, e.g., MACMILLAN, *supra* note 2, at 304, 308-14 (noting the Gage case’s breadth); Bhaskara P. Shelley, *Footprints of Phineas Gage: Historical Beginnings on the Origins of Brain and Behavior and the Birth of Cerebral Localizationism*, 4 *ARCHIVES MED. & HEALTH SCIS.* 280, 281 (2016) (explaining that Harlow’s 1848 article is “one of the most frequently

injury was also the first opportunity to focus on such seemingly complex qualities as judgment, temperament, and impulse control, thus heralding in the field of neuropsychology and the traditional case study approach to the cognitive and social neurosciences.¹² Yet, the fantastical accounts of Gage's post-accident personality changes, "too monstrous for belief,"¹³ are what captivated history and made Gage famous.¹⁴ According to one familiar view, as a result of his injury, Gage was "an unstable, impatient, foul-mouthed, work-shy drunken wastrel, who drifted around circuses and fairgrounds, unable to look after himself, and dying penniless in an institution."¹⁵ Indeed, my survey of the last thirty-seven law review articles that mentioned Gage consistently depicted him as "antisocial,' 'fitful,' 'irreverent,' 'grossly profane,' 'garrulous,' 'sexually promiscuous,' 'reckless,' 'unreliable' and 'irresponsible.'"¹⁶

This heinous and distorted biography of Gage was fueled in part by the limited number of primary sources documenting Gage's life, coupled with his accident's unlikelihood.¹⁷ Yet, just as important were the experts involved in assessing Gage's injuries (either directly or not) and reporting their opinions about them. For example, over a century after the accident, a prominent neuroscientist controversially wrote a book based in part on his negative assumptions about Gage's injuries and behavior to help analyze his patients.¹⁸ We now know that many of the rumors about Gage—including the

cited articles from nineteenth-century neurology literature"); Arnold LeUnes, *Contributions to the History of Psychology: XX. A Review of Selected Aspects of Texts in Abnormal Psychology*, 35 PSYCH. REPS. 1319, 1322-26 (1974) (documenting the frequent citation of Harlow's 1868 article prior to 1950).

12. See Shelley, *supra* note 11, at 281.

13. MACMILLAN, *supra* note 2, at 279 (citation omitted).

14. See, e.g., *id.* at 368-80.

15. Malcolm Macmillan & Matthew L. Lena, *Rehabilitating Phineas Gage*, 20 NEUROPSYCHOLOGICAL REHAB. 641, 643 (2010) (providing an updated perspective on Gage based on new information).

16. See Deborah W. Denno, *Analysis of Law Review Articles Mentioning Phineas Gage* (July 30, 2021) (unpublished document) (on file with author).

17. See MACMILLAN, *supra* note 2, at 279-337. The change in accounts about Gage came with the publication of Malcolm Macmillan's book. See Denno, *supra* note 16, at 3 (differentiating between materials on the subject written before and after 2000, the year Macmillan published his book).

18. See ANTONIO R. DAMASIO, *DESCARTES' ERROR: EMOTION, REASON, AND THE HUMAN BRAIN* 34-39 (1994).

ones in that book—were false or undocumented.¹⁹ Australian psychologist Malcolm Macmillan started to set the record straight in 2000 in his stunningly comprehensive book and articles.²⁰ According to Macmillan, Gage thrived in unexpected ways during his short lifetime, despite his injuries.²¹

Why would I begin an Article on imagining the future of law and neuroscience with a brain story nearly two centuries old that others have addressed so many times? One expected answer, of course, is that the past is typically a strong predictor of the future. And the Gage case is a compelling crystal ball. For starters, almost immediately after his injury, Gage became a pawn in contentious debates in science over how the brain works.²² Today, we recognize that parts of the brain are specialized for particular purposes.²³ But, in the nineteenth century, other scientists held a more holistic perspective,²⁴ an approach based on the limits of brain science at the time. How and to what extent there were reported changes in Gage's sociabilities would support one scientific view over the other and thus influence the diverging narratives about Gage's brain.²⁵ These kinds of scientific turf wars certainly exist today,²⁶ and they will likely become even more pronounced in the future.

In the context of the criminal justice system, for example, experts continuously present testimony driving the narrative about criminal defendants depending on whether they are hired by the prosecution or defense.²⁷ Deciding which story is most persuasive lies in the

19. See Denno, *supra* note 16, at 3. For a critique of Damasio's account of Gage in the first several chapters of *DESCARTES' ERROR* and elsewhere, see Zbigniew Kotowicz, *The Strange Case of Phineas Gage*, 20 HIST. HUM. SCIS. 115, 130 n.6 (2007) ("Damasio is the principal perpetrator of the myth of Gage the psychopath Damasio changes [Harlow's] narrative, omits facts, and adds freely [H]is account of Gage's last months ... is ... a grotesque fabrication ... insinuating that Gage was some riff-raff who in his final days headed for California to drink and brawl himself to death.").

20. See, e.g., MACMILLAN, *supra* note 2, at 279-337; Macmillan & Lena, *supra* note 15, at 642-43 (providing an updated perspective on Gage); Macmillan, *supra* note 10, at 182.

21. Macmillan & Lena, *supra* note 15, at 642-43.

22. See *infra* notes 72-77 and accompanying text.

23. See Shelley, *supra* note 11, at 280.

24. See *infra* notes 75-77 and accompanying text.

25. See discussion *infra* Part I.B.

26. See *infra* notes 81-92 and accompanying text.

27. See, e.g., Deborah W. Denno, *How Prosecutors and Defense Attorneys Differ in Their Use of Neuroscience Evidence*, 85 FORDHAM L. REV. 453 (2016) (examining how the defense and prosecution use neuroscientific evidence differently in their arguments in death penalty

hands of the judge or jury.²⁸ There are also striking parallels between how experts have portrayed Gage over nearly two centuries and how experts in the legal community characterize defendants with brain injuries today.²⁹ While Gage was never charged or prosecuted for a crime (despite rumors suggesting otherwise), the case remains a metaphor for misunderstandings about brain injured individuals, inside and outside of the law.

The purpose of this Article is to explore how experts have dominated the neuroscience narrative in U.S. criminal cases for twelve decades, from 1900-2020. Stepping back and tracing trends provides perspective on the future of law and neuroscience because “[h]istory, in this sense, is all we have.”³⁰ The discussion focuses on insanity cases because most such cases involve brain damage or abnormality and thus rely heavily on neuroscientific evidence.³¹ In addition, for the past 120 years, insanity tests and standards have remained exceptionally stable relative to other criminal law doctrines.³² The criminal justice system’s heavy reliance on scientific

cases); Gary Edmond, *Science, Law and Narrative: Helping the ‘Facts’ to Speak for Themselves*, 23 S. ILL. U. L.J. 555, 580-81 (1999) (emphasizing “that the role of scientists being enrolled (or enrolling themselves) and assisting in the construction of cases, especially the development of prosecution and plaintiff narratives, both in criminal and civil litigation, are important to the construction and configuration of legal narratives”).

28. See Peter Brooks, “*Inevitable Discovery*”—*Law, Narrative, Retrospectivity*, 15 YALE J.L. & HUMANS. 71, 71 (2003) (noting that narrative structure, or more plainly “stories,” is a driving force within the courtroom).

29. Compare Denno, *supra* note 16, at 3 (citing descriptions of Gage as “antisocial,” “garrulous,” and “reckless”), with Deborah W. Denno, *The Myth of the Double-Edged Sword: An Empirical Study of Neuroscience Evidence in Criminal Cases*, 56 B.C. L. REV. 493, 531-43 (2015) (discussing how prosecutors use evidence of a defendant’s brain damage to suggest that they will be a future danger to others and engage in violent acts), and Sean D. O’Brien & Kathleen Wayland, *Implicit Bias and Capital Decision-Making: Using Narrative to Counter Prejudicial Psychiatric Labels*, 43 HOFSTRA L. REV. 751, 753 (2015) (reporting data from the Capital Jury Project emphasizing “the importance of narrative to the decision-maker’s ability to understand and respond to mitigating evidence, especially when such evidence includes psychiatric or cognitive impairments,” and also showing that “jurors have difficulty assimilating mitigating mental health testimony because they distrust mental health experts as ‘hired guns,’ and because the ‘antisocial’ or ‘psychopathic’ labels invoke the fictitious popular-culture stereotypes of violent criminals,” and that “[a]s a result, life-or-death decisions can be made based on damaging stereotypes and pervasive cultural myths associated with criminal behavior and prejudicial psychiatric labels”); see also *infra* Part IV.

30. GADDIS, *supra* note 1, at 3.

31. See discussion *infra* Part II.C.2.

32. See *Kahler v. Kansas*, 140 S. Ct. 1021, 1039 (2020) (Breyer, J., dissenting) (explaining that while states have long tweaked and experimented with the language of insanity

or medical experts in insanity cases—irrespective of the type of neuroscientific evidence introduced into court—has also been remarkably fixed.³³ The following discussion contends that, despite the increasing influx of neuroscientific evidence and its purported greater objectivity into the criminal justice system, experts still dominate the narrative of how that evidence, including a defendant’s insanity claim, is viewed. While experts are a necessary and invaluable contribution to this process, they can also dangerously distort a defendant’s psychological and medical identity; these twists are especially pronounced when the evidence and insanity constructs are ambiguous, as they inevitably are.³⁴

To support these arguments, this Article reports the results of my original Twelve-Decade Neuroscience Study (The Study) examining the criminal justice system’s use of the insanity defense in all criminal cases—totaling 8,358—involving neuroscientific evidence over the past twelve decades, from 1900 to 2020. Neuroscience—defined generally as “the branch of the life sciences that studies the brain and nervous system”—opened a world of cognitive discovery that often questions the efficacy of established legal doctrines and mores.³⁵ Given The Study’s vast range of data and scope, the timeline of 120 years provides a crucial past and present approach to predict the future of neuroscience.

Part I of this Article discusses the history of the Gage case and its accompanying inaccuracies, noting how early and later expert evaluations of Gage remained fixed and influential over the years despite scientific advances and discoveries about Gage’s life. The Gage case also heralded the criminal justice system’s increasing reliance

provisions, four main insanity tests have evolved, all with shared philosophies and goals, and that “with striking consistency, they all express the same underlying idea: A defendant who, due to mental illness, lacks sufficient mental capacity to be held morally responsible for his actions cannot be found guilty of a crime”).

33. For an excellent discussion of this issue in an article published seventy years ago, see Henry Weihofen, *Eliminating the Battle of Experts in Criminal Insanity Cases*, 48 MICH. L. REV. 961 (1950).

34. See Michael L. Perlin, *Myths, Realities, and the Political World: The Anthropology of Insanity Defense Attitudes*, 24 BULL. AM. ACAD. PSYCHIATRY L. 5, 13-17 (1996).

35. See NEUROSCIENCE AND THE LAW: BRAIN, MIND, AND THE SCALES OF JUSTICE 206 (Brent Garland ed., 2004); see also OWEN D. JONES ET AL., LAW AND NEUROSCIENCE 931 (2d ed. 2021) (defining neuroscience as “[t]he scientific study of the structure and function of the nervous system; includes experimental and clinical studies of animals and humans”).

on testifying experts, fueling the centrality of the courtroom's "battle of the experts," especially in criminal insanity cases involving neuroscience experts. Part II reviews the origins and development of this country's major insanity tests, as well as The Study's efforts to identify the law and science behind insanity defense trends in the context of fluctuating crime rates. By analyzing The Study's data, Part III examines the nature and extent of the plunging insanity defense rates and the reasons for the decline, including the impact of the 1982 John Hinckley Jr. verdict. The Part also explores The Study's successful post-*Hinckley* insanity cases and the limited number of circumstances and characteristics in which courts found a defendant insane.

Part IV investigates how The Study's insanity defense narratives use experts in neuroscience to both support and refute insanity-related claims by employing more sophisticated information to develop a fuller picture of the defendant. While the defense hires experts to help link defendants' mental health problems to their criminal behavior and offer a mitigating narrative for insanity, prosecutors have increasingly relied on accusations of defendant malingering to dispute these strategies. For example, The Study found that malingering issues have increased eight-to-ten fold over the past twelve decades, and expert support of malingering claims can be very persuasive. This Article questions the fairness and utility of the divisive power of experts in insanity cases over the past 120 years, noting the scientific vestiges of the Gage case. Imagining a future of law and neuroscience would help bring a more informed and consensus-oriented approach to criminal justice experts.

I. PHINEAS GAGE AND THE PUSH-AND-PULL OF EXPERTS

The case of Phineas Gage is a tale told by the original experts who evaluated him and the different scientific disciplines that used him to present their version of how the brain operates. If ever there was a roadmap for depicting the impact of the narratives of various specialists, the Gage case would be it, starting with his physicians. For example, Gage was among the first thoroughly documented brain injury cases "where the roles of the patient and the treating

physician evolved” clinically over time.³⁶ Yet, these roles gave treating physicians enormous power in determining their patients’ behavioral narratives, especially if they assumed a particular perspective, as Gage’s expert physicians did.³⁷

A. *Expert Physicians*

John Harlow, Gage’s primary doctor, provided the most firsthand documentation about Gage because Harlow treated him shortly after the accident.³⁸ Indeed, nearly all of the original information about Gage derives from two short articles of Harlow’s published twenty years apart in 1848 and 1868.³⁹ According to Harlow’s account, Gage had an impeccable reputation before his injury.⁴⁰ Gage was “the most efficient and capable foreman in [his bosses’] employ”⁴¹ a man of “temperate habits” and “considerable energy of character” and physical strength—a “great favorite” with his co-workers.⁴²

Those who knew Gage agreed that he possessed “a well-balanced mind” and was “a shrewd, smart business man, very energetic and persistent in executing all his plans of operation.”⁴³ Yet, these perceptions switched abruptly after the accident.⁴⁴ According to Harlow’s interviews, Gage’s “mind was radically changed, so decidedly that his friends and acquaintances said he was ‘no longer Gage.’”⁴⁵ The injury substantially transformed Gage’s behavior and

36. Alan G. Lewandowski et al., *Phineas Gage: A Neuropsychological Perspective of a Historical Case Study*, in OXFORD HANDBOOK ONLINE 31 (William B. Barr & Linas A. Bieliauskas eds., 2020).

37. John F. Kihlstrom, *Social Neuroscience: The Footprints of Phineas Gage*, 28 SOC. COGNITION 757, 768 (2010) (noting phrenological influences in Harlow’s 1848 and 1868 articles).

38. See *Harlow 1848*, *supra* note 4, at 389-90. According to Harlow, Gage’s accident took place at 4:30 PM on September 13, 1848, and Harlow did not arrive until 6:00 PM to examine him. *Id.* Edward H. Williams, M.D., was the first doctor to see Gage, about thirty minutes after Gage’s accident. See *id.* Thereafter, Harlow took over. *Id.*

39. See *id.*; *Harlow 1868*, *supra* note 4.

40. See *Harlow 1848*, *supra* note 4, at 389-90.

41. *Harlow 1868*, *supra* note 4, at 339.

42. *Harlow 1848*, *supra* note 4, at 389-90.

43. *Harlow 1868*, *supra* note 4, at 340.

44. See *id.*

45. *Id.*

personality, seemingly for life.⁴⁶ And so the tales and contradictions about Gage started to evolve over the decades, bedeviled, it seems, by warring factions within medicine and psychology that twisted Gage's life in whatever direction suited them.⁴⁷

Harlow's two depictions of Gage over twenty years—which changed substantially—exemplify these conflicts.⁴⁸ In Harlow's first report, published two months after Gage's incident, he wrote of Gage's positive attributes, reputation, and “most heroic firmness” in handling his injuries.⁴⁹ Harlow also found that, within a month post-injury, Gage's “[i]ntellectual faculties [were] brightening” and his “memory [was] as perfect as ever.”⁵⁰ While he viewed Gage as being “very childish” for wanting to go home to be with his family and noted that Gage “[d]oes not estimate size or money accurately,” all else in his five-page report described Gage and his health positively.⁵¹ Nearly four months after Gage's accident, in a brief update of the case, Harlow noted that Gage was then home with his family in Lebanon, New Hampshire, “walking about the house, and riding out, improving both mentally and physically.”⁵²

Yet, twenty years later—nearly a decade after Gage died—Harlow published another article, downplaying some of his initial positive assessments about Gage's advances.⁵³ In this 1868 piece, Harlow emphasized instead Gage's “very childish” and “obstinate” ways, noting that Gage was “impatient of restraint” and resisting control “by his friends” due to his wishes to go home to see his family or to purchase items at a store.⁵⁴ Seven months post-injury, Harlow recounted that Gage's “physical health [was] good” despite some facial scarring and paralysis, vision loss in his left eye, and some depression in his skull.⁵⁵ Yet, Harlow noted that Gage's behavior

46. *See id.*

47. *See* discussion *infra* Part I.B.

48. *Compare Harlow 1848, supra* note 4, at 392, *with Harlow 1868, supra* note 4, at 340.

49. *Harlow 1848, supra* note 4, at 390.

50. *Id.* at 392.

51. *Id.*

52. *See Medical Miscellany*, 39 BOS. MED. & SURGICAL J. 506, 507 (1849) (quoting from “[a] note, dated Jan. 3d, [1849], from Dr. Harlow, of Cavendish, Vt., the medical attendant of Mr. Gage”).

53. *See Harlow 1868, supra* note 4, at 339-40.

54. *Id.* at 337.

55. *Id.* at 339.

and personality seemingly changed radically, and Gage could not recoup his job or friends.⁵⁶ As Harlow explained, “[t]he equilibrium or balance, so to speak, between [Gage’s] intellectual faculties and animal propensities, seems to have been destroyed.”⁵⁷ Gage became “fitful, irreverent, indulging at times in the grossest profanity (which was not previously his custom), manifesting but little deference for his fellows,” and unable to make stable plans.⁵⁸

Such regressions aside, Harlow’s accounts also revealed Gage’s persistence in one facet: from minutes after his accident to the day he died, Gage always wanted to work and work hard.⁵⁹ In 1851, just three years after the incident, Gage was employed in a livery stable in New Hampshire for nearly eighteen months.⁶⁰ After that, he was hired by a man going to Chile to start a line of stagecoaches.⁶¹ In Chile, Gage cared for horses and drove a six-horse coach for nearly eight years when, in 1860, his health failed and he returned to San Francisco, where his mother and sister then lived.⁶² Despite arriving “in a feeble condition, having ... suffered much from hardship and exposure” in Chile, Gage’s health improved.⁶³ Again, Gage was keen to work and soon took on farm labor and other manual jobs.⁶⁴ Unfortunately, months later, Gage died unexpectedly from a series of convulsions over two days.⁶⁵ While there was no autopsy, Gage’s mother gave Harlow her son’s skull and tamping iron, which Harlow would be the first to study intensively before donating it to the Museum of Harvard Medical School.⁶⁶

Harlow’s 1868 article offers insights about why Gage survived his original accident for over a decade. Gage’s strong “physique, will, and capacity of endurance, could scarcely be excelled,” and the iron tamping rod’s round and smooth shape eased its entry and exit

56. *Id.*

57. *Id.*

58. *Id.* at 339-40.

59. *See id.* at 340.

60. *Id.*

61. *Id.*

62. *Id.* at 340-41.

63. *Id.* at 341 (quoting from a letter written by Gage’s mother about Gage’s condition).

64. *Id.*

65. *Id.* at 341-42.

66. *Id.* at 342.

points in a more resilient part of Gage's brain.⁶⁷ Yet, Harlow was not the only one to examine Gage in such medical detail. In January 1850, Henry Bigelow, a professor of surgery at Harvard University, invited Gage to visit Boston for several weeks to assess Gage's condition.⁶⁸ Bigelow yearned to provide proof of "so remarkable an injury" with a "complete record" including "the testimony of a number of persons who were cognizant of the accident or its sequel."⁶⁹ Unfortunately, apart from compiling verbatim documentation that the injury and brain loss occurred, Bigelow added little by way of insight about Gage's condition and nothing about Gage's personality or behavior.⁷⁰ That said, the nature and extent of Gage's brain loss "without impairing its functions" led Bigelow to agree that Gage's case was unprecedented⁷¹—the verification the medical community needed.

B. Competing Ideologies

Such a spotlight on Gage, in addition to the scant and inconsistent firsthand information about him, regrettably fueled the perception that his purported changes were permanent.⁷² Experts controlled his narrative and twisted his story.⁷³ The circumstances also spawned a tug of war among competing ideologies of the brain that may have influenced Harlow's change in viewpoints from his 1848 article to his 1868 article twenty years later.⁷⁴ For example, the Gage case has enabled "the fitting of almost any theory to the small number of facts" available,⁷⁵ thereby becoming a "Rorschach inkblot" for conflicting views of the structure and function of the brain.⁷⁶

67. *Id.* at 344.

68. Bigelow, *supra* note 6, at 13.

69. *Id.* These individuals included Joseph Adams, the owner of the hotel where Gage was staying, *id.* at 14-15, the Rev. Joseph Freeman, who saw Gage shortly after the accident, *id.* at 15, Edward H. Williams, M.D., the first physician to see Gage within a half-hour after the accident, *id.* at 15-16, and John Harlow, M.D., *id.* at 17-19.

70. *See id.* at 14-15, 17, 22.

71. *Id.* at 22.

72. Macmillan & Lena, *supra* note 15, at 641-42.

73. *See, e.g.*, MACMILLAN, *supra* note 2, at 309-13.

74. *See, e.g.*, Macmillan & Lena, *supra* note 15, at 647-49. Most notably, Harlow's 1868 interpretations may have been influenced by his support for phrenology. *See id.* at 649.

75. MACMILLAN, *supra* note 2, at 290.

76. METACOGNITION AND COGNITIVE NEUROPSYCHOLOGY: MONITORING AND CONTROL

These views ranged from cerebral localization to phrenology to the somatic marker hypothesis, with some unsupported claims that the Gage case spawned psychosurgery, especially frontal lobotomy.⁷⁷ Even neurologist Oliver Sacks stressed “the interpretations and misinterpretations [of Gage], from 1848 to the present,”⁷⁸ while psychologist Christian Jarrett emphasized how Gage has been used to promote a widespread series of myths.⁷⁹ Throughout “hundreds of psychology and neuroscience textbooks, plays, films, poems, and YouTube skits” is one premise: “Personality is located in the frontal lobes, ... and once these are damaged, a person is changed forever.”⁸⁰

Yet, Macmillan and Matthew Lena’s 2010 account of Gage’s life, based on recently discovered records, suggests that Gage achieved “a reasonably good social recovery” and adapted well to his traumatic brain injury.⁸¹ “Although ... Phineas may not have been the Gage he once had been, he seems to have come much closer to being so than is commonly believed.”⁸² For example, the authors point to a recently discovered daguerreotype (photograph) of Gage, which Gage seemingly arranged to have taken, that shows Gage as “self-assured” and with “surprisingly limited disfigurement.”⁸³ Indeed, the owners of the Gage daguerreotype stress that Gage “was a handsome man,” “well dressed and confident, even proud.”⁸⁴ Likewise, Macmillan and Lena detail Gage’s many accomplishments during his post-accident years, especially the “complex skills,” “foresight,” physical strength, and rigor expected of his stagecoach driving

PROCESSES 57-58 (Giuliana Mazzoni & Thomas O. Nelson eds., 1998).

77. See MACMILLAN, *supra* note 2, at 290 (discussing the range of conflicting theories about the brain in interpreting Gage’s injuries, personality, and behavior); see also Macmillan, *supra* note 10, at 182 (discussing the theories of David Ferrier and Sigmund Freud).

78. OLIVER SACKS, AN ANTHROPOLOGIST ON MARS: SEVEN PARADOXICAL TALES 59-61 (1995).

79. See Christian Jarrett, *What the Textbooks Don’t Tell You About Psychology’s Most Famous Case Study*, BRIT. PSYCH. SOC’Y RSCH. DIG. (June 30, 2015), <https://digest.bps.org.uk/2015/06/30/what-the-textbooks-dont-tell-you-about-psychologys-most-famous-case-study/> [<https://perma.cc/8WAH-KT8F>].

80. CHRISTIAN JARRETT, GREAT MYTHS OF THE BRAIN 38 (2015).

81. See Macmillan & Lena, *supra* note 15, at 642.

82. *Id.* at 655.

83. *Id.* at 644.

84. Jack Wilgus & Beverly Wilgus, *Face to Face with Phineas Gage*, 18 J. HIST. NEUROSCIENCES 340, 343-44 (2009) (“One theory about Gage—that his personality might have changed because his appearance was made grotesque by the accident ... no longer seems credible to us.” (citation omitted)).

position in Chile.⁸⁵ In addition, Gage needed “to learn something of the local language and customs.”⁸⁶ Even a doctor who “knew Gage well” in Chile stated that Gage enjoyed “good health, with no impairment whatever of his mental faculties.”⁸⁷

Importantly, Macmillan and Lena also correct misleading historical accounts about Gage. They provide a persuasive point-by-point critique of Harlow’s negative and distorted perspectives on Gage’s “child[ish]” and “obstinate” behaviors, interpreting them in a more sensible, empathic, and positive context.⁸⁸ Gage’s “obstinacy,” for example, “is consistent with a post-accident Phineas intent on recovering as much of his pre-accident self as possible and with a daily life structured by his work.”⁸⁹ Thus, it appears that brain-injured individuals put in highly structured environments can regain some of their original functions and personalities.⁹⁰

In the twenty-first century, Gage’s brain still fascinates, supporting a theory of brain specialization, just not in the way phrenologists had proposed. Indeed, in a 2012 study in PLOS One, researchers created a 3-D model of Gage’s skull using modern neuroimaging.⁹¹ According to the researchers, the model suggested that the damage to Gage’s brain mainly occurred to Gage’s left frontal lobe, an area associated with decision-making and emotional processing, explaining some of Gage’s more subtle deficits and why parts of his brain could regenerate.⁹²

The purpose here is not to detail the neuropsychological aspects of these findings—that is for another article to do—but rather to ask why this modern comparison with earlier accounts about Gage is so

85. Macmillan & Lena, *supra* note 15, at 645.

86. *Id.*

87. John Dawson & J. W. Hamilton, *Editorial and Miscellaneous*, 13 OHIO MED. & SURGICAL J. 171, 174 (1861).

88. Macmillan & Lena, *supra* note 15, at 642.

89. *Id.* at 654.

90. *Id.* at 651-52.

91. See John Darrell Van Horn et al., *Mapping Connectivity Damage in the Case of Phineas Gage*, PLOS ONE (May 16, 2012), <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0037454> [<https://perma.cc/VRA6-KLUV>].

92. *Id.*

essential. While “the facts and mythology of [the Gage] case have captured the imagination of generations of future neuropsychologists,”⁹³ they have also hindered and dehumanized rehabilitation efforts.⁹⁴ The Gage case has shown that even severely brain-damaged individuals can defy the savage and stigmatizing stories about them and live a full life, due to the brain’s resilience and adaptation to purposeful and structured environments.⁹⁵

This overview brings us back to the starting question: What does the story of Phineas Gage have to do with the future of law and neuroscience? While Gage was an unprecedented brain-injury case, it also revealed the extent to which an evolving clinical relationship between patients and treating physicians⁹⁶ could enable physicians to create their patients’ behavioral narratives, as Harlow did in his purported embrace of phrenology.⁹⁷ The Gage case was also a harbinger of a growing movement in this country’s history when testifying experts in court began to take on a prominent position in a “battle of the experts,” especially in criminal insanity cases involving neuroscience experts.⁹⁸

The following Part provides a backdrop for this discussion, starting first with an overview of major insanity defenses, then The Study. This Article applies The Study’s results to question the strong and consistent power of experts in insanity cases over the past 120 years (starting soon after the Gage case), and to predict where those experts will be in the twenty-second century. The neuroscientific aspects of these cases have attracted little attention, yet they have broad implications, not just for the insanity defense, but also for the future of law and neuroscience.

93. Lewandowski et al., *supra* note 36, at 32.

94. *See generally* Macmillan & Lena, *supra* note 15, at 651-52 (detailing the long road mental care professionals traversed—due to a lack of quality, unadulterated primary sources—to craft a rehabilitation regimen that closely resembled Gage’s).

95. *Id.* A striking recent example of such recovery can be found in the case of Daniel Carr, who lost a substantial part of his brain when he experienced a stroke as a newborn only to find that his brain was able to remap itself. *See* Meeri Kim, *A Newborn Lost Large Parts of His Brain. Today, He’s an Athletic College Grad.*, WASH. POST (Jan. 22, 2022, 9:00 AM), https://www.washingtonpost.com/health/perinatal-stroke/2022/01/21/7347c514-3903-11ec-91dc-551d44733e2d_story.html [<https://perma.cc/8UMH-E95L>].

96. Lewandowski et al., *supra* note 36, at 31.

97. Kihlstrom, *supra* note 37, at 768 (noting phrenological influences in Harlow’s 1848 and 1868 articles).

98. *See* Weihofen, *supra* note 33, at 962.

II. THE INSANITY DEFENSE ACROSS TWELVE DECADES

The insanity defense has long reflected “the fundamental moral principles of our criminal law, resting on assumptions that are older than the Republic and beliefs about human rationality, deterrability and free will.”⁹⁹ Despite the defense’s longstanding history and significance, there is relatively little empirical research relating to its application in criminal law.¹⁰⁰ In addition, most of the existing empirical work centers around a specific time frame and scope due to various data-gathering constraints, incomplete records, and methodological choices.¹⁰¹ This Part provides a brief overview of major insanity tests and discusses the underpinnings of The Study. As the discussion will show, insanity tests have remained stable over the decades with minimal changes to their overall substance, thus providing a firm foundation to examine the narrative impact of experts.

A. Major Insanity Tests

Five main insanity tests evolved over the centuries with shared philosophies and goals. “[W]ith striking consistency, they all express the same underlying idea: A defendant who, due to mental illness, lacks sufficient mental capacity to be held morally responsible for his actions cannot be found guilty of a crime.”¹⁰² These tests are the *M’Naghten* rule; the “irresistible impulse” test; the “*Durham*” or “product” standard; the American Law Institute’s Model Penal Code

99. MICHAEL L. PERLIN & HEATHER ELLIS CUCOLO, 3 MENTAL DISABILITY LAW: CIVIL AND CRIMINAL § 14-1.1 (3d ed. 2021) (footnotes omitted) (internal quotations omitted). The first insanity acquittal was recorded in 1505 in England. See NIGEL WALKER, CRIME AND INSANITY IN ENGLAND 25-26 (1968).

100. See generally Richard A. Pasewark, *A Review of Research on the Insanity Defense*, 484 ANNALS AM. ACAD. POL. & SOC. SCI. 100, 101 (1986); Richard A. Pasewark & Hugh McGinley, *Insanity Plea: National Survey of Frequency and Success*, 13 J. PSYCHIATRY & L. 101 (1985) [hereinafter Pasewark I]; Hugh McGinley & Richard A. Pasewark, *National Survey of the Frequency and Success of the Insanity Plea and Alternative Pleas*, 17 J. PSYCHIATRY & L. 205 (1989) [hereinafter Pasewark II]; Carmen Cirincione & Charles Jacobs, *Identifying Insanity Acquittals: Is It Any Easier?*, 23 LAW & HUM. BEHAV. 487 (1999).

101. See Pasewark, *supra* note 100, at 101.

102. *Kahler v. Kansas*, 140 S. Ct. 1021, 1039 (2020) (Breyer, J., dissenting).

test; and the federal standard for insanity.¹⁰³ Presently, forty-five states, the federal government, and the District of Columbia have an insanity defense.¹⁰⁴ More than half (thirty states or 60 percent) of all states have adopted the *M'Naghten* rule and its offspring tests.¹⁰⁵ In turn, another thirteen states and the District of Columbia use the Model Penal Code standard.¹⁰⁶ New Hampshire alone uses the “*Durham*” or “product” test, and North Dakota’s test is a “unique formulation,” that considers “whether the defendant ‘lacks substantial capacity to comprehend the harmful nature or consequences of the conduct, or the conduct is the result of a loss or serious distortion of the individual’s capacity to recognize reality.’”¹⁰⁷ Five states have effectively eliminated the insanity defense.¹⁰⁸

Of the five major insanity tests, the *M'Naghten* rule is the earliest and most famous, established in 1843 by the English House of Lords in *M'Naghten’s Case*—five years before the Gage incident.¹⁰⁹ The first part of the test concerns a defendant’s “cognitive [] capacity,” or whether the defendant was aware of their actions—a phrase

103. See *infra* notes 109-25 and accompanying text.

104. *Kahler*, 140 S. Ct. at 1046 (Breyer, J., dissenting). For a comprehensive breakdown of the types and numbers of insanity tests across states, see *id.* app. at 1051-59. Several U.S. territories also have an insanity defense, including the U.S. Virgin Islands, Guam, Puerto Rico, American Samoa, and the Northern Mariana Islands. See V.I. CODE ANN. tit. 14, § 14(4) (2021); 9 GUAM CODE ANN. § 7.16 (2021); P.R. LAWS ANN. tit. 34A, App. II, Rule 74 (2021); AM. SAMOA CODE ANN. § 46.1301 (2021); N. Mar. I. R. Crim. P. 12.2.

105. *Kahler*, 140 S. Ct. at 1046 (Breyer, J., dissenting).

106. *Id.*

107. *Id.* (quoting N.D. CENT. CODE ANN. § 12.1-04.1-01(1) (2012)).

108. These five states “exonerate a mentally ill defendant only when he cannot understand the nature of his actions and so cannot form the requisite *mens rea*.” *Id.* at 1026 n.3 (majority opinion); see also KAN. STAT. ANN. § 21-5209 (2021); ALASKA STAT. §§ 12.47.010(a), 12.47.020 (2021); IDAHO CODE § 18-207(1), (3) (2021); MONT. CODE ANN. § 46-14-102 (2021); UTAH CODE ANN. § 76-2-305 (LexisNexis 2021).

109. (1843) 8 Eng. Rep. 718, 722 (HL). The English House of Lords presented the defense as follows:

[T]o establish a defence on the ground of insanity, it must be clearly proved that, at the time of the committing of the act, the party accused was labouring under such a defect of reason, from disease of the mind, [1] as not to know the nature and quality of the act he was doing; or, [2] if he did know it, that he did not know he was doing what was wrong.

Id.

that “corresponds roughly to the modern concept of *mens rea* for many offenses.”¹¹⁰ The second part, “moral []capacity,” inquires, “even if the defendant knew what he was doing, did he have the capacity to know that it was wrong?”¹¹¹ Strikingly, the *M’Naghten* two-part approach to insanity has been this country’s most widely used test since its adoption.¹¹²

Critics have long condemned *M’Naghten* for its stringent language, limiting defendants’ efforts to prove their insanity.¹¹³ Likewise, the tests that followed *M’Naghten* were developed “to expand, not contract, the scope of the insanity defense.”¹¹⁴ Some courts broadened the *M’Naghten* test with an “irresistible-impulse” standard that recognized that the defendant’s lack of capacity could also include a lack of control.¹¹⁵ Broader still was the “*Durham*” or “product” test introduced in 1954, developed to accommodate modern psychiatric insights.¹¹⁶ However, *Durham*’s departure from standard insanity jurisprudence was met with roadblocks; the only state to adopt a version of it is New Hampshire.¹¹⁷

The most successful attempt to replace the *M’Naghten* standard was the American Law Institute’s 1962 Model Penal Code test, which substantially expanded both prongs of *M’Naghten* and introduced a volitional impairment component.¹¹⁸ Under the Model

110. *Kahler*, 140 S. Ct. at 1038 (Breyer, J., dissenting); *see also M’Naghten*, 8 Eng. Rep. at 722.

111. *Kahler*, 140 S. Ct. at 1038 (Breyer, J., dissenting); *see also M’Naghten*, 8 Eng. Rep. at 722.

112. *See Kahler*, 140 S. Ct. at app. 1051-55 (Breyer, J., dissenting).

113. JOSHUA DRESSLER, UNDERSTANDING CRIMINAL LAW 324, 329 (8th ed. 2018).

114. *Kahler*, 140 S. Ct. at 1045 (Breyer, J., dissenting).

115. *Id.*

116. *See Durham v. United States*, 214 F.2d 862, 876 (D.C. Cir. 1954) (“The jury’s range of inquiry will not be limited to, but may include, for example, whether an accused, who suffered from a mental disease or defect did not know the difference between right and wrong, acted under the compulsion of an irresistible impulse, or had been deprived of or lost the power of his will.” (internal quotations omitted)), *overruled by* *United States v. Brawner*, 471 F.2d 969, 1010 (D.C. Cir. 1972) (Bazelon, C.J., concurring) (“We are unanimous in our decision today to abandon the formulation of criminal responsibility adopted eighteen years ago in [*Durham*]... [J]uries will now be instructed in terms of the American Law Institute test.”).

117. *Kahler*, 140 S. Ct. at 1045-46 (Breyer, J., dissenting). The U.S. Virgin Islands has as well. *See Virgin Islands v. Fredericks*, 578 F.2d 927, 930 (3d Cir. 1978).

118. *See Kahler*, 140 S. Ct. at 1036 n.12; Deborah W. Denno, *Who Is Andrea Yates? A Short Story About Insanity*, 10 DUKE J. GENDER L. & POL’Y 1, 11-17 (2003) (examining the differences between *M’Naghten* and the Model Penal Code test).

Penal Code's test, individuals are not responsible for their criminal conduct if, because of mental disease or defect, they either lacked "substantial capacity" to appreciate the "criminality" (or, depending on the state legislature, the "wrongfulness") of their conduct, or they failed to "conform" their conduct "to the requirements of law."¹¹⁹ The test, which quickly garnered support from legislatures and courts, was adopted nearly unanimously by federal circuit courts and over half of the states by the 1980s.¹²⁰

The Model Penal Code's popularity gained momentum until 1982, when it suffered an enormous setback. On June 21 of that year, a jury found John Hinckley Jr. not guilty by reason of insanity for his attempted assassination a year earlier of then-President Ronald Reagan, based on the Model Penal Code standard.¹²¹ Public furor over Hinckley's acquittal was swift and urgent: the federal government and some states eliminated the Model Penal Code's volitional component and introduced other restrictions, including a return to a *M'Naghten*-type standard.¹²² Few states resorted to reframing or effectively abolishing the insanity defense,¹²³ yet the Hinckley verdict shattered the Model Penal Code's foothold.¹²⁴ In 1984, Congress enacted its version of the *M'Naghten* test—the "Federal

119. MODEL PENAL CODE § 4.01(1) (AM. L. INST., Official Draft and Explanatory Notes 1985) [hereinafter MODEL PENAL CODE 1985]. The exact standard is as follows: "A person is not responsible for criminal conduct if at the time of such conduct as a result of mental disease or defect he lacks substantial capacity either to appreciate the criminality [wrongfulness] of his conduct or to conform his conduct to the requirements of law." *Id.* (alteration in original).

120. PERLIN & CUCOLO, *supra* note 99, § 14-1.2.5.

121. See *From Daniel M'Naughten to John Hinckley: A Brief History of the Insanity Defense*, PBS, <https://www.pbs.org/wgbh/pages/frontline/shows/crime/trial/history.html> [<https://perma.cc/QT5J-4SBR>]. For excerpts from the trial transcript and a discussion of the events surrounding Hinckley's attempted assassination, as well as further legal proceedings up to 2020, see generally RICHARD J. BONNIE ET AL., *A CASE STUDY IN THE INSANITY DEFENSE: THE TRIAL OF JOHN W. HINCKLEY, JR.* (4th ed. 2021). An overview of the facts of the case can also be found in *Hinckley v. United States*, 163 F.3d 647, 648-49 (D.C. Cir. 1999). After Hinckley's verdict, he was committed to a federal institute for psychiatric care. See Spencer S. Hsu, *Would-Be Reagan Assassin John Hinckley Jr. Wins Unconditional Release*, WASH. POST (Sept. 27, 2021, 3:30 PM), https://www.washingtonpost.com/local/legal-issues/john-hinckley-unconditional-release/2021/09/27/8e5f5286-1f9f-11ec-9309-b743b79abc59_story.html [<https://perma.cc/WG5L-F9AV>]. On September 27, 2021, a federal judge awarded Hinckley unconditional release beginning in June 2022. See *id.*

122. See HENRY J. STEADMAN ET AL., *BEFORE AND AFTER HINCKLEY: EVALUATING INSANITY DEFENSE REFORM* 46-47 (1993).

123. See *supra* note 108 and accompanying text.

124. See, e.g., STEADMAN ET AL., *supra* note 122, at 44.

test”—thus quashing the federal system’s near-unanimous adoption of the Model Penal Code test.¹²⁵ In line with this Article’s focus and discussion of Gage, the battle of the experts was deemed crucial in the Hinckley case.¹²⁶ While this battle has been detailed elsewhere, the turf wars among experts made clear that, irrespective of the factual and doctrinal aspects of an insanity case, how particular experts presented information was highly persuasive to the case’s outcome. As this Article later demonstrates, this Hinckley effect also seemingly contributed to a steep decline in this country’s use of the insanity defense.¹²⁷

Identifying other potential influences during this period, especially crime trends, helps put insanity tests into fuller perspective and appreciate the narrative focus of insanity cases. Examining the ebbs and flows of criminality over time also offers some view for the future, given the effects of the pandemic and other societal and cultural forces, in conjunction with expert testimony.

B. Crime Rate Trends

Crime rate trends provide, even generally, a context with which to examine other types of trends in criminal justice systems. For example, over the 120 years from 1900 to 2020, the insanity defense showed a near-linear decline in use.¹²⁸ In contrast, while crime rates varied across this period, the rates generally increased from 1900 until they reached their highest peak in history in the early 1980s.¹²⁹ Crime rates then dropped modestly until they spiked again

125. The “Federal test” states:

It is an affirmative defense to a prosecution under any Federal statute that, at the time of the commission of the acts constituting the offense, the defendant, as a result of a severe mental disease or defect, was unable to appreciate the nature and quality or the wrongfulness of his acts. Mental disease or defect does not otherwise constitute a defense.

18 U.S.C. § 17(a).

126. BONNIE ET AL., *supra* note 121; STEADMAN ET AL., *supra* note 122, at 46-47.

127. *See infra* notes 187-90 and accompanying text.

128. *See infra* Figures 1-3.

129. *See* U.S. DEP’T OF JUST., CRIME AND JUSTICE ATLAS 2000 37 (2000). Much of the crime rate data comes from the Uniform Crime Reporting program, which publishes annual crime rate data. No single source addresses crime rates for all serious crimes during the 120-year span (1900-2020) that this author reviewed. However, data from various sources was pulled together to provide an overview of the crime rate trends during this expanse of time. *See id.*

to their second-highest levels in the early 1990s.¹³⁰ Thereafter, crime rates began a near-continuous decline leading up to 2019.¹³¹ Significant events such as the Great Depression and Vietnam War precipitated some of the more pronounced increases or decreases in crime rates.¹³²

A further examination of specific eras situates the crime rate increase. For example, violent crime surged from 1900-1925 in the wake of changing social and cultural forces.¹³³ Murder rates, in particular, continued to climb, and they peaked during the height of the Great Depression in the early 1930s.¹³⁴ Starting in the mid-1930s, however, violent crime began to decline and ultimately plateaued until the 1960s.¹³⁵ From the 1960s up to the mid-1970s, during the Vietnam War (which spanned from 1961-1975), violent crime rates soared.¹³⁶ Through the mid-1970s, the crime rate trends continued their overall upward momentum, with rates fluctuating at all-time highs from year to year.¹³⁷ These rates peaked during the early 1980s, followed by a modest decline, and peaked again during the early 1990s.¹³⁸

at 34 (surveying the United States index crimes—crimes of homicide, rape, robbery, and aggravated assault—from 1933-1998 based on data collected from the Uniform Crime Reporting program and homicide rates from 1900-1998, as well as the Centers for Disease Control and Prevention’s National Center for Health Statistics (NCHS)); Fed. Bureau of Investigation, *Crime Data Explorer* (Sept. 28, 2020), <https://crime-data-explorer.fr.cloud.gov/pages/explorer/crime/crime-trend> [<https://perma.cc/3GCV-N8NG>] (showing crime rate trends from 1986 to 2019 for violent crimes, including homicide, rape, robbery, and aggravated assault); see also Jeffrey S. Adler, *Less Crime, More Punishment: Violence, Race, and Criminal Justice in Early Twentieth-Century America*, 102 J. AM. HIST. 34, 36-42 (2015) (discussing lethal and nonlethal crime rates from 1900 to 1940).

130. See U.S. DEPT OF JUST., *supra* note 129, at 36-37.

131. See *id.* at 37; Fed. Bureau of Investigation, *supra* note 129.

132. See U.S. DEPT OF JUST., *supra* note 129, at 38-39 (showing trends in murder rates in relation to historical events).

133. See Adler, *supra* note 129, at 36 (“[T]he start of the twentieth century reflected ... a surge in the proportion of young men in the population, an increase in racial conflict and ethnic tensions, and shifts in gender roles.... Prohibition, organized crime, and bootlegging contributed only modestly to the surge in lethal violence during the 1920s.”).

134. *Id.* at 36, 39-40; U.S. DEPT OF JUST., *supra* note 129, at 38.

135. See U.S. DEPT OF JUST., *supra* note 129, at 36-39. Despite the overall trend towards declining crime rates for index crimes, there was a brief increase in murder rates following soon after the end of World War II in 1945 before the rates began declining again. *Id.*

136. *Id.*

137. *Id.*

138. *Id.*; Fed. Bureau of Investigation, *supra* note 129.

Thus, after a nearly continuous incline in crime rates from the 1960s to the 1990s, crime rates started a virtually uninterrupted decline.¹³⁹ By the early 2010s, violent crime rates declined to levels similar to those reported during the early 1970s.¹⁴⁰ A slight increase in crime occurred from 2014 to 2016 but has started to decrease again through 2019, the last year of official crime reporting.¹⁴¹

There are time and data constraints to this analysis. At this writing, detailed crime rates for 2020 are still being documented, and 2021 and 2022 data are not yet available. That said, preliminary reports show that the COVID-19 pandemic influenced crime rates through 2020 and is likely to continue to impact crime rates through 2021 and beyond, much like other historic events.¹⁴² Preliminary reports of crime rates during 2020 also show that homicides and domestic violence rates increased while robberies and property crimes decreased.¹⁴³ This spike in homicides was particularly pronounced in major cities throughout the United States.¹⁴⁴

On the heels of the nearly continuous climb in crime rates in the 1960s, changing prosecutorial policies and aggressive punitive sentencing resulted in a rapidly growing prison population in the 1970s.¹⁴⁵ Although crime rates declined from the mid-1990s through 2019, incarceration rates increased by 500 percent in the nearly forty-year period between 1980 and 2019.¹⁴⁶ Incarceration rates

139. See U.S. DEPT OF JUST., *supra* note 129, at 36-39; Fed. Bureau of Investigation, *supra* note 129.

140. See NATHAN JAMES, CONG. RSCH. SERV., R45236, RECENT VIOLENT CRIME TRENDS IN THE UNITED STATES 1-5 (2018).

141. *Id.*; Fed. Bureau of Investigation, *supra* note 129. At the time this Article was being written, the Uniform Crime Reporting program only released crime rate trends through 2019, and this author only looked at crime rate trends up to this point. Fed. Bureau of Investigation, *supra* note 129.

142. See RICHARD ROSENFELD ET AL., PANDEMIC, SOCIAL UNREST, AND CRIME IN U.S. CITIES: 2020 YEAR-END UPDATE 6-8, 18-20 (2021), https://craftmediabucket.s3.amazonaws.com/uploads/Year_End_Crime_Update_Design.pdf [<https://perma.cc/QZ9X-FDJ3>]; see also Spencer Bokat-Lindell, *Why Are So Many Americans Killing One Another?*, N.Y. TIMES (Jan. 20, 2022), <https://www.nytimes.com/2022/01/20/opinion/murder-rate-police-homicide.html> [<https://perma.cc/HFP2-Q226>].

143. ROSENFELD ET AL., *supra* note 142, at 6-14.

144. See *id.* at 6-7, 18-21.

145. See generally JOHN F. PFAFF, LOCKED IN: THE TRUE CAUSES OF MASS INCARCERATION—AND HOW TO ACHIEVE REAL REFORM (2017).

146. See *Criminal Justice Facts*, THE SENT'G PROJECT (2020), <https://www.sentencingproject.org/criminal-justice-facts/> [<https://perma.cc/22VY-L5W6>]; JED S. RAKOFF, WHY THE

soared, climbing consistently from the 1970s until the rates peaked in the late 2000s.¹⁴⁷ After this peak, incarceration rates began a modest decline during the early 2010s that has continued through 2019 and is likely to continue amidst pandemic concerns regarding the prison population.¹⁴⁸

To different degrees, all of these crime trend factors influence how the criminal justice system operates. In imagining the future of law and neuroscience, then, such forces would also be expected to affect how that system will interpret and use neuroscientific evidence.

C. The Twelve-Decade Neuroscience Study

Past empirical research has revealed foundational information about the insanity defense.¹⁴⁹ Yet, The Twelve-Decade Neuroscience Study updates and expands critical substantive and methodological gaps in existing empirical data. The Study's timeframe also provides an idea of neuroscience and expert testimony going into the future.

1. Goals

The primary purpose of The Study is broad-based: to examine all criminal cases, totaling 8,358, that involved neuroscientific evidence over the past twelve decades, from January 1, 1900, to December 31, 2020. This large-scale empirical research project offers an unprecedented opportunity to investigate how neuroscience meshes with the legal system's framework from multiple and diverse perspectives, ranging from the evolving use of neuroimaging and expert testimony

INNOCENT PLEAD GUILTY AND THE GUILTY GO FREE AND OTHER PARADOXES OF OUR BROKEN LEGAL SYSTEM 7 (2021).

147. See James Cullen, *The History of Mass Incarceration*, BRENNAN CTR. FOR JUST. (July 20, 2018), <https://www.brennancenter.org/our-work/analysis-opinion/history-mass-incarceration> [<https://perma.cc/B4BC-9ZEP>]; *Criminal Justice Facts*, *supra* note 146.

148. See Cullen, *supra* note 147; *Criminal Justice Facts*, *supra* note 146. However, not surprisingly, the data are complex and continuously shifting, with some projecting that some noted drops are "temporary." See Wendy Sawyer, *New Data: The Changes in Prisons, Jails, Probation, and Parole in the First Year of the Pandemic*, PRISON POL'Y INITIATIVE (Jan. 11, 2022), https://www.prisonpolicy.org/blog/2022/01/11/bjs_update/ [<https://perma.cc/7E9G-BL CG>].

149. See *supra* notes 100-01 and accompanying text.

over time to the impact of childhood trauma.¹⁵⁰ The Study also considers how neuroscience can promote a safer, fairer, and more efficient criminal justice system. Focusing on insanity cases only, this Article's specific goal is to analyze how experts present neuroscientific evidence in this particular context. No matter the type of neuroscientific evidence a case uses or the decade in which that case occurred, experts are the key link in how the evidence is explained to criminal justice actors. An overview of the role of experts within insanity cases is especially insightful because the insanity defense has existed in all states across The Study's time frame of 120 years.

2. Methodology

This Article's methodology and coding processes are described in detail in Appendix A.¹⁵¹ In general, The Twelve-Decade Neuroscience Study's cases were acquired employing the Westlaw and Lexis databases. Searches were made for "criminal law" cases and, within that group, additional searches for "neuroscientific evidence," based on The Study's operational definitions.¹⁵²

In collecting The Study's data, I defined "neuroscientific evidence" as incorporating three broad groups of search terms: (1) "neuroimaging tests" (brain scans), which are generated by computer images of a human brain—such as an MRI or CT scan; (2) "non-neuroimaging tests," which are tests administered by a medical professional to an individual to assess how that person's brain operates—such as the Wechsler Intelligence Scale for Children (WISC) or the Wechsler Adult Intelligence Scale (WAIS); and (3) terms associated with "expert testimony."¹⁵³

In the early twentieth century, defense and prosecuting attorneys relied mostly on expert testimony,¹⁵⁴ despite the start, as early as 1925, of crude forms of brain imaging.¹⁵⁵ Of course, such

150. See *infra* Figure 4; see also *infra* Appendix A.

151. *Infra* Appendix A.

152. *Infra* Appendix A.

153. See *infra* Appendix A; Statistical Appendix, at 265-354 (on file with author).

154. See *infra* Figure 4.

155. The earliest "brain imaging" case in the The Study's data set is *People v. Krauser*. 146 N.E. 593, 596 (Ill. 1925) (noting that defense experts took "[r]adio pictures of [Krauser's]

testimony was not as sophisticated or detailed as in later decades. Likewise, modern neuroimaging technology did not yet exist, and non-neuroimaging testing was limited. Regardless, because expert testimony still controls most modern-day neuroscientific evidence, The Study can reliably draw twelve-decade comparisons. For example, even in cases using advanced neuroimaging technology, expert testimony remains heavily influential, making the comparisons between past and recent cases all the more telling for imagining the future of law and neuroscience.

To ensure validity and reliability for examining all cases across the twelve decades, The Study employed trained and experienced Fordham Law School J.D. student research assistants. These assistants hand-coded and analyzed over 100 key factors relevant to the criminal justice system. Then, they created a different, more concentrated coding system to investigate insanity cases.¹⁵⁶

Set criteria established whether a case would be included in The Study: a court must have announced a disposition in a case where a party either introduced or sought to introduce neuroscientific evidence at any point in the proceeding, including the innocence-or-guilt phase, penalty phase, post-conviction hearing, and evidentiary hearing. Cases in which neuroscientific evidence was introduced post-trial were added in The Study only if a court took action based on that evidence. Such action could include granting an evidentiary hearing, finding ineffective assistance of counsel for counsel's failure to pursue the evidence, or finding prior court error for failure to admit the evidence. For example, The Study contains several post-conviction cases, including a death row defendant claiming ineffective assistance of counsel.¹⁵⁷

3. Drawbacks

There are notable drawbacks to relying on the Westlaw and Lexis databases. These databases contain only published opinions and,

skull" that "show[ed] a thickening over the back of the occipital bone, encroaching somewhat upon the space that should be occupied by the part of the brain known as the cerebellum").

156. See *infra* Appendix A.

157. See, e.g., *Clark v. Dugger*, 834 F.2d 1561 (11th Cir. 1987); *In re Fields*, 800 P.2d 862 (Cal. 1990); *Pratt v. Armenakis*, 112 P.3d 371 (Or. Ct. App. 2005); *Crawford v. State*, 218 So. 3d 1142 (Miss. 2016).

therefore, exclude plea agreements and the substantial numbers of cases that other insanity defense researchers gathered from state criminal dockets, forensic directors, the media, or other sources.¹⁵⁸ Likewise, searches for “criminal law” cases in both Westlaw and Lexis are inexact because both databases miscode; for example, searches consistently contain a certain percentage of civil law cases that need to be removed.¹⁵⁹ Researchers must carefully read each case not only to hand-code it but also to make a decision to exclude it if it is not a criminal case.

In addition, this Article excludes an unknown number of criminal cases that do not fit within the (unusually broad) parameters of neuroscientific evidence that this Article details.¹⁶⁰ That said, this selection strategy provides a universe of cases from two well-established legal databases that ensure relative consistency and accountability across the 120 years The Study examines. Because documentation is available for all the cases used to create the figures in this Article,¹⁶¹ the Study’s methodology enables anyone to verify or replicate the search methods.

III. THE FUTURE OF THE INSANITY DEFENSE AND NEUROSCIENCE

This Part examines the results of The Twelve-Decade Neuroscience Study to gauge how insanity defenses—and the neuroscientific

158. See generally Mary Rumsey, *A Guide to Fee-Based U.S. Legal Research Databases*, N.Y.U. L. GLOB. BLOG (Aug. 2005), https://www.nyulawglobal.org/globalex/US_Fee-Based_Legal_Databases.html#_III._Major_Vendors [<https://perma.cc/9YJE-U2RN>] (listing the categories of sources provided by Westlaw and LexisNexis); see also GARY B. MELTON ET AL., *PSYCHOLOGICAL EVALUATIONS FOR THE COURTS: A HANDBOOK FOR MENTAL HEALTH PROFESSIONALS AND LAWYERS* 200 (4th ed. 2018) (citing studies indicating that, on average, over 75 percent of insanity verdicts result from a plea or bench determinations).

159. See generally Maya Sen, *Is Justice Really Blind? Race and Reversal in US Courts*, 44 J. LEGAL STUD. S187, S197-98 nn.4-5 (2015) (attributing some disparities in research findings to miscoding by legal databases).

160. Because the potential universe of cases that reference criminal law is almost infinite, cases that involve everything from neuroimaging to medical professionals to expert testimony give us a reasonable proxy for the cases in which the nature of insanity itself is most at issue. Likewise, relative to other such studies, both national and international, The Study’s definition of neuroscientific evidence is exceptionally broad and inclusive. See Deborah W. Denno, *Empirical Use of Neuroscientific Evidence in Criminal Justice*, in *ENCYCLOPEDIA OF BEHAVIORAL NEUROSCIENCE* 719-30 (2d ed. 2021) (comparing and contrasting the methodological details of seven systematic and empirical studies).

161. See Statistical Appendix (on file with author); *infra* Figures 1-7.

evidence on which these defenses rely—are used now and how they may be employed in the future. Expectedly, most of The Study's cases involve defendants convicted of murder or other types of violent crimes, and nearly two-thirds began as capital cases.¹⁶²

A. *Insanity Defense Rates*

Figure 1 provides some of The Study's foundational information.¹⁶³ Not surprisingly, based on this Article's crime rate analysis,¹⁶⁴ Figure 1 shows a general increase in the number of criminal law cases—totaling 8,358—that involve neuroscientific evidence over the decades.¹⁶⁵ That growth is nearly linear, as crime rates are, with a pronounced increase in 1980, when crime rates throughout the country soared.¹⁶⁶ Predictably, given the decline in crime rates during the 1990s and 2000s, the number of cases involving neuroscience took a comparable downswing.¹⁶⁷ That said, neuroscience cases increased in the last decade (2010-2020),¹⁶⁸ seemingly because the criminal justice system is becoming more receptive to such evidence.

162. See Statistical Appendix, at 367-774 (on file with author).

163. See *infra* Figure 1.

164. See *supra* notes 128-38 and accompanying text.

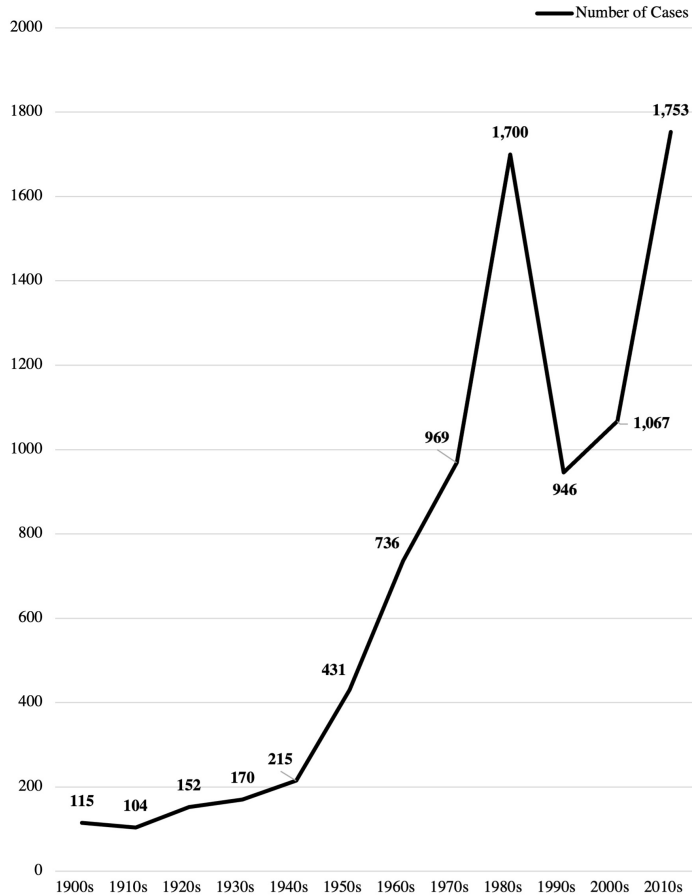
165. See *infra* Figure 1.

166. See *infra* Figure 1.

167. See *infra* Figure 1.

168. *Infra* Figure 1.

Figure 1. Number of Criminal Law Cases Involving Neuroscientific Evidence per Decade from 1900-2020: 8,358 Total



The next question, considered in Figure 2, is whether insanity defense cases followed the same kind of trajectory as Figure 1.¹⁶⁹ The Study defines insanity defense cases as any case in which (1) a defendant asserted or intended to assert an insanity defense, (2) a defendant argued that an insanity defense should have been raised, or (3) a court discussed an insanity issue of some kind.

169. See *infra* Figure 2.

First, there are predictable parallels between the distributions in Figures 1 and 2 in part because the insanity cases—which total 3,300¹⁷⁰—were drawn from the pool of Figure 1's 8,358 criminal law neuroscience cases.¹⁷¹ Altogether, over the decades, over one-third (39.48 percent) of the total pool of criminal law neuroscience cases contained insanity cases (a ratio of 3,300 over 8,358).¹⁷² This total percentage of insanity cases is significantly higher than what other studies have demonstrated¹⁷³ for two reasons: (1) the insanity defense was raised with far greater frequency in the earlier decades,¹⁷⁴ a period that no study has examined empirically,¹⁷⁵ and (2) the criminal cases in Figure 1 were selected according to whether they involved some kind of neuroscientific evidence.¹⁷⁶ In general, Figure 2 shows that the cases involving an insanity defense rose steadily over the decades until the 1980s, after which the number of cases quickly declined.¹⁷⁷

170. See Statistical Appendix, at 1-264 (on file with author).

171. See *id.* at 186-259.

172. Compare *supra* Figure 1, with *infra* Figure 2.

173. See generally Lisa A. Callahan et al., *The Volume and Characteristics of Insanity Defense Pleas: An Eight-State Study*, 19 BULL. AM. ACAD. PSYCHIATRY L. 331, 331-32 (1991); Pasewark I, *supra* note 100; Pasewark II, *supra* note 100; Cirincione & Jacobs, *supra* note 100.

174. See *infra* Figure 3.

175. See *supra* note 129 and accompanying text.

176. See *supra* Figure 1.

177. See *infra* Figure 2.

Figure 2. Number of Insanity Defense Cases per Decade from 1900-2020: 3,300 Total Cases¹⁷⁸

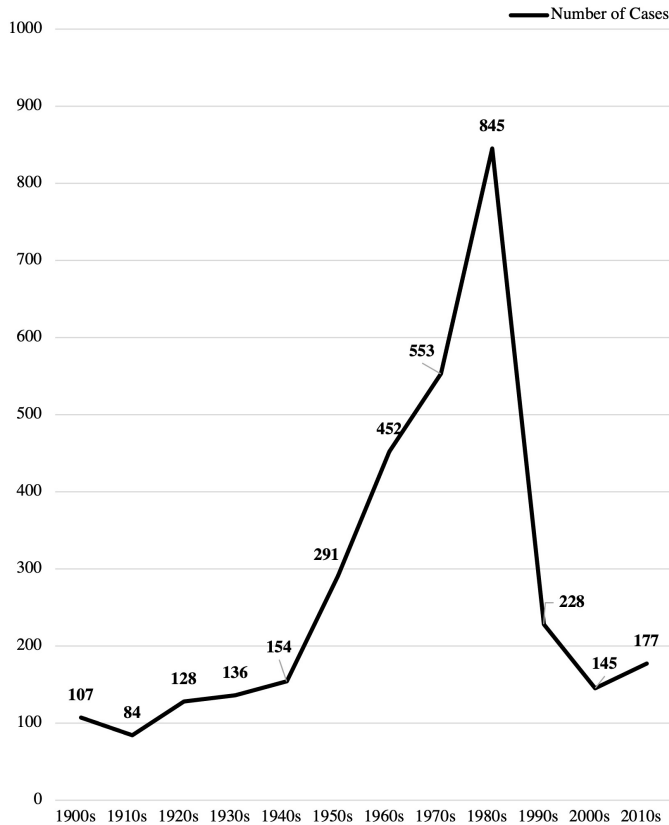


Figure 3 reveals the nature and extent of this decline among insanity defense cases¹⁷⁹ by presenting percentages rather than raw numbers—specifically, the number of insanity defense cases per the number of criminal law cases involving neuroscientific evidence per decade, from 1900-2020.¹⁸⁰ In other words, Figure 3 shows the decade-by-decade ratio of the number in Figure 2 over the number

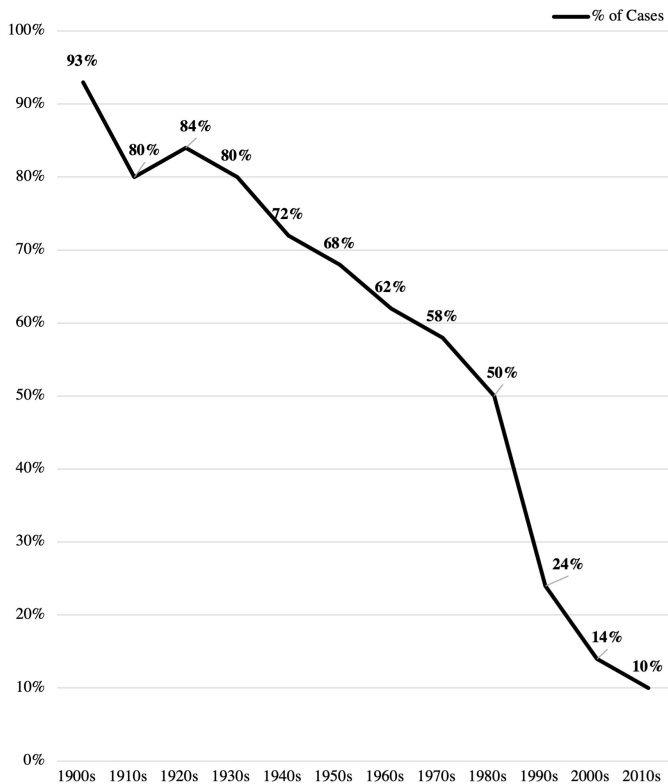
178. Figure 2's insanity defense cases were drawn from the pool of 8,358 cases in Figure 1. See Statistical Appendix, at 191-264 (on file with author).

179. See *infra* Figure 3.

180. See *infra* Figure 3.

in Figure 1.¹⁸¹ The results in Figure 3 are striking. In the first decade of the twentieth century (from 1900-1910), insanity defense cases constituted the vast majority—93 percent—of all cases that concerned neuroscientific evidence.¹⁸² From that first decade, Figure 3 shows a near-linear decline in insanity defense cases across every decade, down to 10 percent of all cases in the 2010-2020 decade.¹⁸³

Figure 3. Percentage of Insanity Defense Cases per Decade from 1900-2020: 3,300 Total Cases¹⁸⁴



181. Compare *supra* Figure 1, and *supra* Figure 2, with *infra* Figure 3.

182. See *infra* Figure 3.

183. See *infra* Figure 3.

184. Figure 3 is a ratio of 3,300 cases over 8,358 cases (that is, the number of cases in Figure 2 over the number in Figure 1).

1. *Reasons for the Plummeting Rates*

There are seemingly two transparent reasons for the declining rates in the insanity defense. First, the rapid drop between the 1980s and 1990s can be most readily attributable to the impact of the *Hinckley* verdict and the institution of the Insanity Defense Reform Act of 1984. The bulk of empirical research and legislative changes on the insanity defense that this Article reviewed supports this interpretation.¹⁸⁵ Kansas was the last of five states to “reframe” or “effectively abolish” the insanity defense due to *Hinckley* (in 1995); yet, the other four states did so within either a few months or a few years from the verdict (Montana in 1979, Alaska and Idaho in 1982, and Utah in 1983).¹⁸⁶ While no other state has effectively eliminated the insanity defense after Kansas, Figure 3 suggests this *Hinckley* effect may have continued across the next three decades, from 1990-2020.

A second and related reason for the decreasing insanity defense rates pertains to the massive negative public opinion about the insanity defense, which the *Hinckley* verdict fueled all the more. For example, some states switched to narrower insanity standards as general beliefs about the insanity defense became increasingly hostile.¹⁸⁷ Indeed, even before *Hinckley*, multiple surveys of individuals—ranging from politicians, community members, college students, and professionals of all types (from police officers to state hospital aids)—showed that the great majority of respondents believed that the insanity defense enabled defendants to escape responsibility for their crimes.¹⁸⁸ This perspective also affected Montana’s decision to discard the defense in 1979.¹⁸⁹ By the time the *Hinckley* verdict was handed down, these negative beliefs were held

185. See *supra* notes 121-27 and accompanying text.

186. See *supra* note 108 and accompanying text.

187. See BONNIE ET AL., *supra* note 121, at 133, 139-153; Marc Rosen, *Insanity Denied: Abolition of the Insanity Defense in Kansas*, 8 KAN. J.L. & PUB. POL’Y 253, 255-57 (1998).

188. See Rosen, *supra* note 187, at 255-56.

189. For a discussion of why Montana abolished the insanity defense pre-*Hinckley*, see Jeanne Matthews Bender, Comment, *After Abolition: The Present State of the Insanity Defense in Montana*, 45 MONT. L. REV. 133, 137 (1984) (“The abolition of mental disease or defect as an affirmative defense was not triggered by a particular incident, but was apparently an attempt to curtail the role of the mental health professional in criminal trials.”).

by 90 percent of some of those surveyed.¹⁹⁰ Thus, the 1980s brought a perfect storm of factors battering the insanity defense: a long-surging crime rate, anti-insanity defense sentiment among the public, and the 1982 *Hinckley* verdict.

There are at least two additional developments during the 1980s and beyond that seemingly contributed to the plummeting insanity defense rates: (1) attorneys in later decades started to use neuroscience in more tailored ways than just the insanity defense, and (2) courts showed an increased willingness to grant and accept neuroscientific expert testimony for matters other than insanity defenses. Whether these two developments are a cause or result of the decreasing use of insanity defenses is an open question, although they suggest the possibility of a complex causal dynamic.

With respect to attorneys' more tailored uses of neuroscience, as the decades progressed, defense lawyers started to apply neuroscience to legal doctrines beyond just the insanity defense. Figure 1's demonstration of the growth of neuroscientific evidence into the courtroom reflects an increasing sophistication and knowledge of the brain and behavior throughout the decades and a comparable expansion of the mental health sciences.¹⁹¹ Both World Wars I and II, for example, substantially advanced the medical sciences about the causes and consequences of brain trauma.¹⁹² In turn, the 1980s heralded the advent of neuroimaging, even prompting *Hinckley's* defense experts to introduce CT scan results into his trial to bolster their arguments that he suffered from brain abnormalities.¹⁹³ In sum, expanding neuroimaging and non-neuroimaging tests supported a wide range of mental health defenses and mitigation evidence, not just a catch-all insanity defense.

190. See Rosen, *supra* note 187, at 255-56.

191. For analyses of the growth and increasing sophistication of neuroscientific evidence (including imaging and non-neuroimaging tests) in empirical research studies over time, see generally Darby Aono et al., *Neuroscientific Evidence in the Courtroom: A Review*, 4 COGNITIVE RESEARCH: PRINCIPLES AND IMPLICATIONS 1 (2019); Denno, *supra* note 160.

192. For discussions of the social, cultural, and scientific forces behind the development of the brain and behavioral sciences, see Deborah W. Denno, *Crime and Consciousness: Science and Involuntary Acts*, 87 MINN. L. REV. 269 (2002) [hereinafter Denno, *Consciousness*]; Deborah W. Denno, *Criminal Law in a Post-Freudian World*, 2005 U. ILL. L. REV. 601 [hereinafter Denno, *Post-Freudian World*].

193. Virginia Hughes, *Head Case*, 464 NATURE 340, 341 (2010).

Likewise, the 1990s and onward showed neuroscience's vast and various applications in the legal system. For example, now attorneys could incorporate neuroscience to demonstrate a defendant's incapability to form specific intent or, in cases of homicide, a defendant's extreme mental and emotional disturbance.¹⁹⁴ Neuroscientific evidence has been a particularly effective tool for supporting mitigation in the penalty phase of a death penalty case and helping to construct a compelling story of a defendant's life.¹⁹⁵

These narratives detail the defendant's life events that either the prosecution or defense can use to illuminate the defendant's mental state, capacity, or behavior at the time of the crime. While there were more insanity cases in the 1960s and earlier decades, the courts used fewer words (and less neuroscience) to describe them relative to the later decades.¹⁹⁶ Seemingly, the influx of neuroscience has helped the legal system get closer to "the person."¹⁹⁷ It also appears that courts have been more willing to accept neuroscientific expert (and even lay) testimony regarding a defendant's mental capacity.¹⁹⁸ These efforts broadly mirror three interrelated trends: the rapid evolution of neuroscientific discoveries and techniques, society's enhanced understanding of the human brain and behavior, and the growing destigmatization of individuals' mental health challenges over the past half-century.¹⁹⁹

194. For an overview of these applications see generally Denno, *Consciousness*, *supra* note 192, at 323 (extreme mental and emotional disturbance); Denno, *Post-Freudian World*, *supra* note 192, at 655-683 (negating specific intent and conscious will). Other types of applications can be found in a range of different strategies using the cases in the 1992-2012 decades of The Study. See generally, e.g., Deborah W. Denno, *Neuroscience and the Personalization of Criminal Law*, 86 U. CHI. L. REV. 359, 381-91 (2019) [hereinafter Denno, *Personalization*] (analyzing cases relying on neuroscientific evidence in the context of self defense, diminished capacity, incompetency, reduced mens rea, and standards of reasonableness); Deborah W. Denno, *Concocting Criminal Intent*, 105 GEO. L.J. 323 (2017) (examining cases relying on brain imaging in the context of prosecutors attempting to prove intent in the context of Shaken Baby Syndrome); Denno, *supra* note 27 (negating or establishing mens rea).

195. For a discussion of neuroscientific evidence as mitigation in a death penalty case, see Denno, *supra* note 29.

196. See Statistical Appendix at 17-27 (on file with author).

197. See generally Denno, *Personalization*, *supra* note 194 (showing how neuroscientific evidence can effectively humanize defendants).

198. See *supra* Figure 1; Denno, *supra* note 29 (discussing courts' greater openness to admitting neuroscientific evidence).

199. See, e.g., Press Release, Am. Psych. Ass'n, Survey: Americans Becoming More Open About Mental Health (May 2019), <https://www.apa.org/news/press/releases/apa-mental->

In essence, all criminal justice actors, including juries, have multiple opportunities to understand neuroscientific evidence at a level of depth and detail that was not possible in previous decades. Consequently, experts can better explain to a jury certain brain-based defenses, such as diminished capacity, that may also be easier to prove than the insanity defense.

2. *Dominance of Expert Testimony*

The Twelve-Decade Neuroscience Study categorized and defined neuroscientific evidence in three different ways: (1) expert testimony; (2) non-neuroimaging evidence; and (3) neuroimaging evidence.²⁰⁰ This Subsection examines in Figures 4-6 the distribution of these three categories in The Study's 3,300 insanity cases generally to better understand their role and potential significance.²⁰¹ After all, much of the controversy concerning neuroscientific evidence in the courtroom focuses on neuroimaging tests, such as the MRI and CT scans, to the exclusion of non-neuroimaging tests and expert testimony.²⁰² Figures 4-6 suggest that emphasis is misplaced.

Strikingly, expert testimony dominates over non-neuroimaging evidence and even more so over neuroimaging evidence. As Figure 4 shows, expert testimony is present in nearly all insanity cases (97 percent or 3,213 cases) between 1900 and 2020.²⁰³ While such testimony peaks to 99 percent in the 1970s and 1980s, after the 1910s it never falls below 94 percent.²⁰⁴ Yet, while the defense and prosecution rely predominantly on expert evaluations and observations during insanity trials, experts in turn are not relying on non-neuroimaging or neuroimaging tests as much as one would expect.

As Figures 5 and 6 show, non-neuroimaging tests were presented in only 532 (16 percent) of the 3,300 insanity cases from 1900-2020,

health-report.pdf [https://perma.cc/6YRG-9VMS] (“A total of 87% of American adults agreed that having a mental health disorder is nothing to be ashamed of, and 86% said they believe that people with mental health disorders can get better.”).

200. *Infra* Appendix A.

201. *See infra* Figures 4-6.

202. As my overview of other empirical research shows, most research does not distinguish neuroimaging data from non-neuroimaging data or from expert testimony. *See generally* Denno, *supra* note 160, at 719-30.

203. *See* Statistical Appendix, at 265-77 (on file with author).

204. *See infra* Figure 4; Statistical Appendix, at 265-77 (on file with author).

and neuroimaging tests were presented even less—in only 200 (6 percent) of the cases.²⁰⁵ The limited use of neuroimaging and non-neuroimaging testing in the early part of the twentieth century is understandable given the lack of technology and training at that point in history.²⁰⁶ For example, non-neuroimaging testing rose to 42 percent in the 2000s and is still presented in over one-quarter of all cases in the 2010s.²⁰⁷ Yet, somewhat surprisingly, such an increase does not appear for the use of neuroimaging; it grew to its height of only 12.5 percent in the last three decades.²⁰⁸ Likewise, while neuroimaging plateaued at 12.5 percent in these latter decades (appearing in only sixty-nine (12.5 percent) of the 550 insanity cases between 1990 and 2020),²⁰⁹ non-neuroimaging testing was used over twice as much (appearing in 174 cases (31.6 percent) of the 550 insanity cases between 1990 and 2020).²¹⁰

205. See *infra* Figures 5-6.

206. See, e.g., Felix Schirmann, “The Wondrous Eyes of New Technology”—A History of the Early Electroencephalography (EEG) of Psychopathy, Delinquency, and Immorality, 8 FRONTIERS HUM. NEUROSCIENCE 1-2 (2014).

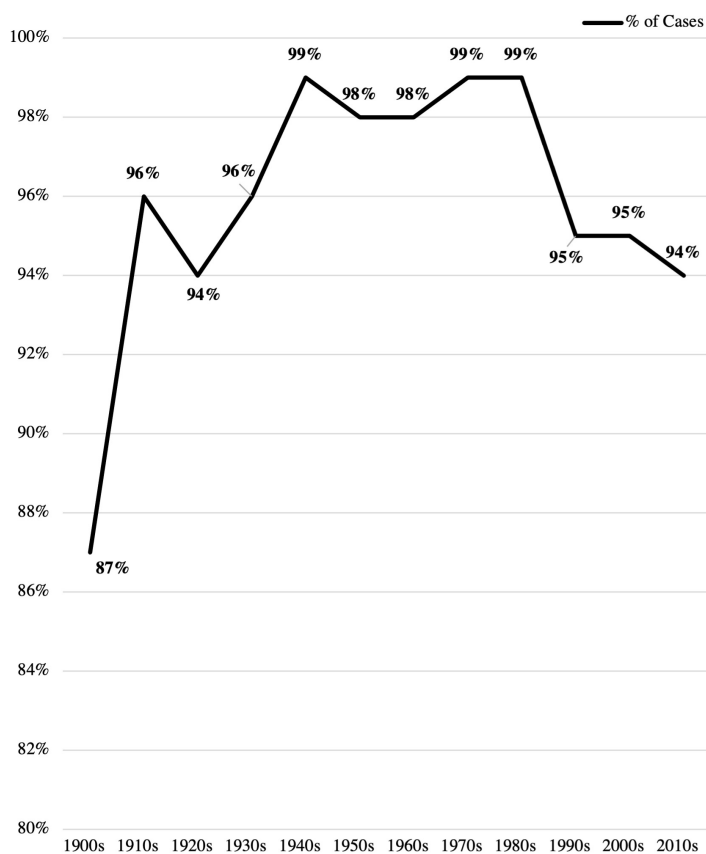
207. See *infra* Figure 5.

208. See *infra* Figure 5.

209. See *infra* Figure 6.

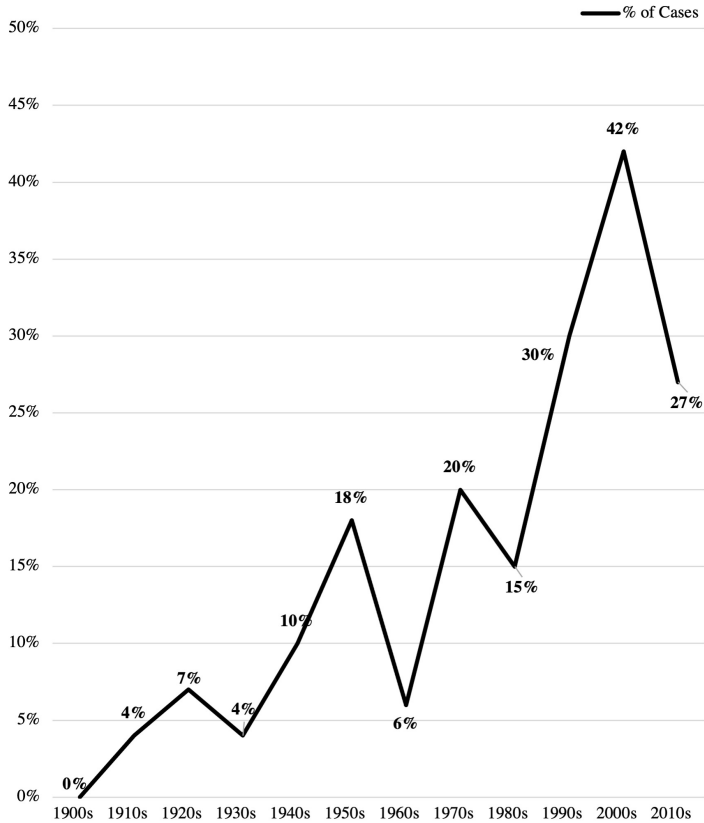
210. See Statistical Appendix, at 352-54 (on file with author).

Figure 4. Percentage of Insanity Defense Cases in Which Expert Testimony Was Presented from 1900-2020: 3,300 Total Cases²¹¹



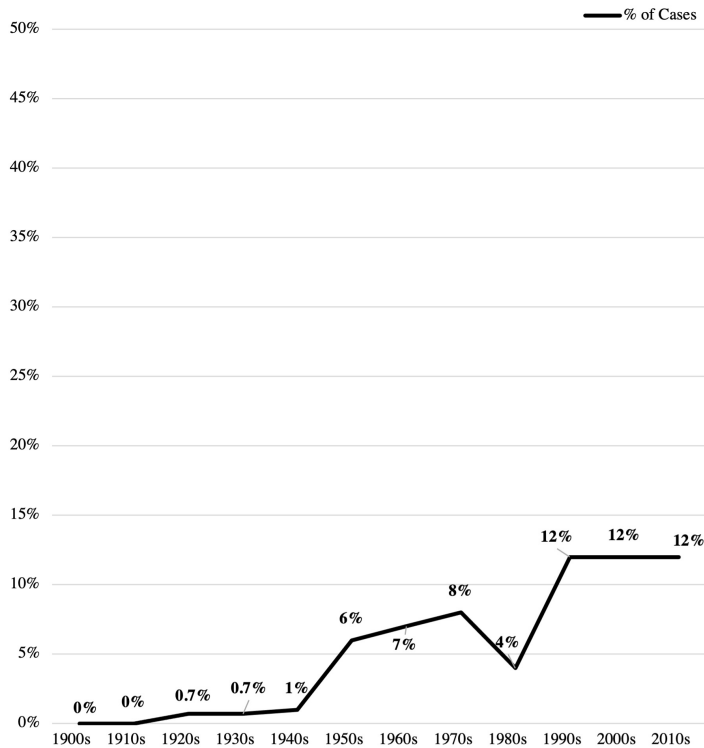
211. Figure 4 identifies the percentage of insanity defense cases in which expert testimony was used to either support or refute an insanity defense. The breakdown per decade is as follows: 1900s-93 cases, 1910s-81 cases, 1920s-120 cases, 1930s-130 cases, 1940s-153 cases, 1950s-285 cases, 1960s-441 cases, 1970s-549 cases, 1980s-839 cases, 1990s-217 cases, 2000s-138 cases, 2010s-167 cases.

Figure 5. Percentage of Insanity Defense Cases in Which Non-Neuroimaging Evidence Was Presented from 1900-2020: 3,300 Total Cases²¹²



212. Figure 5 identifies the percentage of insanity defense in which non-imaging evidence was used to either support or refute an insanity defense. The breakdown per decade is as follows: 1900s-0 cases, 1910s-3 cases, 1920s-9 cases, 1930s-6 cases, 1940s-15 cases, 1950s-52 cases, 1960s-28 cases, 1970s-110 cases, 1980s-131 cases, 1990s-69 cases, 2000s-61 cases, 2010s-48 cases.

Figure 6. Percentage of Insanity Defense Cases in Which Neuroimaging Evidence Was Presented from 1900-2020: 3,300 Total Cases²¹³



For all twelve decades, attorneys overwhelmingly relied on expert testimony as compared to non-neuroimaging and neuroimaging tests. While the categories in Figures 4-6 are not mutually exclusive in terms of the types of neuroscientific evidence presented (there can be overlap), the substantial role of experts is clear.²¹⁴ In imagining the future of law and neuroscience, experts are likely to

213. Figure 6 identifies the percentage of insanity defense in which brain imaging evidence was used to either support or refute an insanity defense. The breakdown per decade is as follows: 1900s-0 cases, 1910s-0 cases, 1920s-1 case, 1930s-1 case, 1940s-2 cases, 1950s-18 cases, 1960s-32 cases, 1970s-47 cases, 1980s-30 cases, 1990s-28 cases, 2000s-17 cases, 2010s-22 cases.

214. See Statistical Appendix, at 265-336 (on file with author).

maintain their dominance, regardless of the growing availability of an even wider array of neuroscientific techniques.²¹⁵ Similarly, legal narratives framing neuroscience are bound to become even more significant.²¹⁶ While there may be no ready end to these neuroscientific stories, a legal system must prepare to accommodate them.

B. Successful Insanity-Related Claims

The results of Figures 4-6 from the Twelve-Decade Neuroscience Study suggest that the last three decades (1990-2020) of The Study's 550 insanity cases warrant closer analysis, especially in an Article about the future of law and neuroscience. Likewise, these post-*Hinckley* decades of insanity cases have remained mostly unexamined by other researchers, despite a general awareness of a post-*Hinckley* effect and The Study's seeming documentation of it in Figures 1-3.

Yet, investigating the parameters of the insanity defense across The Study's 1990-2020 cases prompts a critical question: What factors make for a successful insanity case? This Article defines a "successful case" as one in which the court ruled in favor of the defendant concerning an insanity defense-related claim. Of the 550 insanity cases that were raised from 1990-2020, courts found in favor of defendants in eighty-six (15.64 percent) of those cases.²¹⁷ While the reasons for the success of these cases varied, including court error, this Section focuses on cases in which courts made an actual finding of insanity—what this Section calls "pure" insanity cases. A finding of actual insanity occurred in twenty-three cases (26.74 percent).²¹⁸ Specifically, of the eighty-six cases where the court reversed the defendant's conviction, it found the defendant insane in only twenty-three of those cases. In the remaining sixty-three cases, the court did not determine that the defendant was

215. JONES ET AL., *supra* note 35, at 785-884 (discussing a range of future technologies and aids, ranging from "cognitive enhancement" to "brain-machine interface and law," to "artificial intelligence, robots, and law").

216. See Aono et al., *supra* note 191, at 2-5.

217. See Statistical Appendix, at 363-65 (on file with author).

218. See *id.* at 365.

insane and reversed on other grounds related to the defendant's insanity defense.²¹⁹

Examining the nature and composition of these twenty-three "pure" successful insanity defense cases can reveal more cleanly the role of neuroscientific evidence and expert testimony unencumbered by other procedural or error-related arguments. As would be expected, these cases also share similar features important for forecasting the future.

C. Pure Successful Insanity Cases

An overview of the twenty-three pure successful insanity cases suggests that the defendants who are most likely to be found not guilty by reason of insanity have the following characteristics: (1) a chronic and severe mental illness that causes delusions *and* that is diagnosed by a qualified medical expert; (2) a well-documented and well-supported history of that mental illness; (3) uncontradicted evidence of that mental illness; and (4) proof that, if intoxication was involved in the defendant's crime, it was not the only reason for the defendant's behavior.

Attorneys used experts to support, refute, or determine a defendant's sanity in all twenty-three cases (100 percent). This outcome suggests that, for the most part, a defendant cannot be found not guilty by reason of insanity without assistance from at least one expert. Not surprisingly, in light of Figures 4-6,²²⁰ experts rarely relied on neuroimaging tests to bolster an insanity defense claim, introducing scans in only two of the twenty-three cases (9 percent).²²¹ In turn, non-neuroimaging tests, which were administered in about one-third of the cases, were not always necessary to diagnose a defendant with mental illness or produce a finding of insanity.²²² That said, non-neuroimaging tests commonly played a substantial role in an expert's narrative.²²³

219. *See id.* at 363-65.

220. *See infra* Figures 4-6.

221. *See* Statistical Appendix, at 366 (on file with author); *see, e.g.*, *Dixon v. State*, 668 So. 2d 65, 67-68 (Ala. Crim. App. 1994); *People v. Chavez*, 73 Cal. Rptr. 3d 189, 194-95 (Ct. App. 2008).

222. *See* Statistical Appendix, at 366 (on file with author); *see also, e.g., infra* note 227.

223. *See* Statistical Appendix, at 366 (on file with author).

D. *The Role of Non-Neuroimaging Tests*

Courts look at evidence of insanity as a whole. Therefore, the testimony of an expert who did not administer psychological testing to a defendant but conducted an extensive review of the defendant's psychological history, interviewed family members and other lay witnesses, and spent a reasonable amount of time interviewing and observing the defendant, may be found to be more credible than an expert who only administered psychological testing and produced no other evidence.²²⁴ In some cases, testing may not be appropriate or yield clear or useful results.²²⁵ But, in other circumstances, non-neuroimaging results can be a substantial part of the narrative as they were in the Phineas Gage case.²²⁶

In eight (35 percent) of the twenty-three successful insanity cases, the defendants underwent non-neuroimaging testing.²²⁷ In some of these cases, the tests were merely mentioned and the actual results not discussed.²²⁸ In other cases, the opinion provided more detail concerning how the non-neuroimaging testing contributed to the defendant's diagnosis. For example, in *State v. Jackson*, experts administered to the defendant the Minnesota Multiphasic Personality Inventory, the Benton Visual Retention Test, and other psychological tests.²²⁹ These tests validated a finding of severe mental illness, diagnosed as paranoid schizophrenia and organic delusional disorder,²³⁰ and experts supported an insanity defense.²³¹ Because the experts' assessments stemmed from "recognized psychological

224. *See id.* at 365-66; *see also supra* note 197.

225. *See* Statistical Appendix at 365-66 (on file with author); *see also supra* note 194.

226. *See supra* notes 91-95 and accompanying text.

227. *See Bentley v. State*, 904 So. 2d 351 (Ala. Crim. App. 2004); *Dixon v. State*, 668 So. 2d 65, 67-68 (Ala. Crim. App. 1994); *King v. People*, No. CR-2015-0113, 2017 WL 3600548 (V.I. Aug. 21, 2017); *People v. Chavez*, 73 Cal. Rptr. 3d 189, 194-95 (Ct. App. 2008); *State v. Armstrong*, 671 So. 2d 307 (La. 1996); *State v. Jackson*, 890 S.W.2d 436 (Tenn. 1994); *United States v. Aleksov*, 910 F. Supp. 2d 230 (D.D.C. 2012); *United States v. Murdoch*, 98 F.3d 472 (9th Cir. 1996).

228. *See Dixon*, 668 So. 2d at 67-68 (stating that, although results were not discussed, psychological tests performed on defendant appeared to support a finding that defendant suffered from a delusional disorder).

229. 890 S.W.2d at 439.

230. *Id.* at 439-41.

231. *Id.* at 441.

tests,” the court was swayed to render the defendant not guilty by reason of insanity.²³²

In *United States v. Aleksov*, experts used non-neuroimaging tests to assess whether the defendant, who was previously found to be insane after threatening to kill the President and confined to a mental institution, was at risk of committing violent acts if released from confinement.²³³ Two experts administered the “Violence Risk Appraisal Guide, or VRAG, an actuarial measure of the risk of future violence,” which indicated “that [the defendant] ha[d] a moderately low statistical risk of reoffending: 17% likelihood of recidivism after 17 years.”²³⁴ The experts also administered “the Historical, Clinical, Risk Management-20 (‘HCR-20’), which includes twenty variables empirically validated for association with a risk of violence,” that showed “the Defendant present[ed] a moderate risk of engaging in any violence, and a high risk for engaging in behavior similar to the offense that led to his arrest in this case, including returning to the White House.”²³⁵

To determine if Aleksov still suffered the symptoms of his mental illness, experts also administered the Minnesota Multiphasic Personality Inventory-2 (MMPI-2).²³⁶ The results showed that the defendant “was extremely elevated on the scale for persecutory ideas, which ... suggested potential social isolation and mood lability, meaning a tendency to overreact to minor stressors or perceived insults.”²³⁷ According to the MMPI-2, Aleksov “was vulnerable to real or imagined threats, which could result in dangerous behavior.”²³⁸

232. *Id.*

233. 910 F. Supp. 2d 230, 230, 236-37 (D.D.C. 2012).

234. *Id.* at 236-37.

235. *Id.* at 237.

236. *Id.*

237. *Id.* (citation omitted) (internal quotations omitted).

238. *Id.* (internal quotations omitted). The defendant exhibited a history of violent behavior, three incidents of which led to his arrest and conviction:

First, in December 2007, the Defendant traveled to the White House and got into a scuffle with Secret Service agents. The Defendant was arrested for assaulting an officer, resisting arrest, and interfering with a police officer.... Second, the Defendant was arrested for the offense at issue in this case—threatening the life of then-President George W. Bush. On January 28, 2008, the Defendant walked from his sister’s apartment in Alexandria, Virginia to the White House. The Defendant went up to a secret service agent and stated that

Despite these results, Aleksov argued for his release from the institution to which he was confined and proposed a conditional release plan that included transitioning to a community residential facility and familial supervision.²³⁹ In order to qualify for release, a defendant “must demonstrate by clear and convincing evidence that he does not pose a substantial risk of bodily injury to another person.”²⁴⁰ Perhaps not surprisingly, the court found that, based on Aleksov’s record, including the results of various non-neuroimaging tests, Aleksov “failed to satisfy his burden of proof” and “remain[ed] actively psychotic and delusional.”²⁴¹

In essence, courts rely on non-neuroimaging tests for medical and legal purposes; yet, these tests also add to the narrative of how defendants are perceived and presented, especially by experts. For example, non-neuroimaging testing can be a vehicle for including seemingly more objective testimony into the narrative, even for more controversial and troublesome tests such as risk assessments. These results suggest that the more effective and accurate way for experts to use non-neuroimaging testing is to include it in their testimony based on other kinds of factors, such as the defendant’s medical history, in-person evaluations, et cetera.

While such testing is presumably more objective than expert analysis based purely on opinion, the interpretation of the test results enters the realm of subjectivity. To combat this subjectivity, experts should, as in *Jackson*, corroborate their assessments with other external types of evidence, such as medical records, evaluations by other experts, in-person interviews, observations over time, et cetera. This multi-evidence approach creates a more detailed and comprehensive narrative aided by neuroscientific evidence.

he wanted to kill the President. The Defendant indicated that Satan had “hypnotized,” “instructed,” and “commanded,” him to go to the White House and kill the President.... Third, in February 2008, an urgent care doctor at the D.C. Jail treated the Defendant apparently after an altercation with officers at the Jail.

Id. at 237-38 (citation omitted).

239. *Id.* at 238-39.

240. *Id.* at 240.

241. *Id.* at 241.

IV. HOW INSANITY DEFENSE NARRATIVES USE NEUROSCIENCE EXPERTS

Expert neuroscience testimony is an integral part of criminal court procedure. For centuries, professional experts have assumed an important role in evaluating defendants and presenting mental health findings.²⁴² Neuroscience testimony has been especially significant in insanity cases because the defense relies on experts for its success.²⁴³ By the time of the renowned *M'Naghten* case in 1843, neuroscience testimony was a common addition in the courtroom.²⁴⁴

A. The Defense's Narrative

While expert testimony can be vital for a defendant's case, even in the 1800s it had its fair share of challenges. In 1858, the United States Supreme Court commented that “[e]xperience has shown that opposite opinions of persons professing to be experts may be obtained to any amount.”²⁴⁵ Similarly, a California court stated in 1870 that “these witnesses are generally but adroit advocates of the theory upon which the party calling them relies, rather than impartial experts, upon whose superior judgment and learning the jury can safely rely.”²⁴⁶ Even today, “the prosecution and defense choose the expert most appropriate for supporting their respective legal strategies, which runs the risk of confirmation bias.”²⁴⁷

Despite the challenges that exist when choosing experts, their inclusion helps shape an informed narrative that connects the

242. Winfred Overholser, *Psychiatric Expert Testimony in Criminal Cases Since McNaughton—A Review*, 42 J. CRIM. L. CRIMINOLOGY & POLICE SCI. 283, 284 (1951) (stating that medical testimony played a role in criminal proceedings as early as the trial of Earl Ferrers in 1760).

243. *See, e.g.*, *People v. Gilberg*, 240 P. 1000, 1003 (Cal. 1925) (affirming the lower court's decision to preclude the jury from considering a claim of insanity absent sufficient expert evidence).

244. *See* Overholser, *supra* note 242, at 284.

245. *Winans v. N.Y. & Erie R.R. Co.*, 62 U.S. 88, 101 (1858).

246. *See Grigsby v. Clear Lake Water Works Co.*, 40 Cal. 396, 405 (1870).

247. Amitha Kalaichandran, *We Must Rethink the Role of Medical Expert Witnesses*, SCI. AM. (May 5, 2021), <https://www.scientificamerican.com/article/we-must-rethink-the-role-of-medical-expert-witnesses/> [<https://perma.cc/M6BW-F62F>]; *see also supra* note 27 and accompanying text (detailing depictions of the battle of the experts).

defendant's mental health problems to their criminal behavior. In the context of childhood trauma, for example, my prior research analyzing two decades of neuroscientific evidence has shown that courts are most swayed toward mitigation when defense attorneys can link evidence of the defendant's childhood trauma to their criminality. Experts are vital to making that link.²⁴⁸

This Section presents the narratives of five of The Twelve-Decade Neuroscience Study's pure successful insanity cases to better understand how courts, attorneys, and experts create a defendant's insanity story. In most of these cases, the victims are highly sympathetic (for example, police officers, clergy, or children), and the defendants' acts inconceivably violent—factors that make an insanity defense acquittal all the more difficult. Yet, the cases also share the four characteristics described previously that appear to contribute strongly to a successful insanity defense claim: (1) a severe mental illness that causes delusions *and* that at least one medical expert diagnoses; (2) a comprehensively documented history of that diagnosed mental illness; (3) uncontradicted evidence of that mental illness; and (4) indications that any intoxication that may have contributed to the defendant's crime was not the sole source of their behavior.²⁴⁹

Especially compelling is the degree to which both prosecutorial and defense experts converge in their assessments of a defendant. While both law and science can be adversarial, this type of consensus seemingly evokes the kinds of goals that criminal justice actors should share. After all, the insanity defense should spare from punishment individuals who are rendered incapable of appreciating the nature and consequences of their acts or determining the difference between right and wrong. What follows are depictions of some of those individuals.

248. See generally Deborah W. Denno, *How Courts in Criminal Cases Respond to Childhood Trauma*, 103 MARQ. L. REV. 301 (2019) (showing the results of an empirical study linking childhood trauma to criminality).

249. See *supra* Part III.C.

1. *Police Officer at the Elbow: People v. Armstrong*

In *People v. Armstrong*, the defendant, Freddie Armstrong, appealed a second degree murder conviction and, after a second appeal and remand, was successfully rendered insane at the time of the killing.²⁵⁰ The facts are among the most violent in this group of successful cases, and the experts among the most strongly aligned.

In 1992, Armstrong went to Loche's Mortuary in Bastrop, Louisiana, to acquire a copy of his father's death certificate.²⁵¹ When one of the two people in the office started to help him, Armstrong opened a briefcase containing a large butcher knife, and the person left to get help.²⁵² The second person in the office, Reverend Fred Neal, was left alone.²⁵³ Moments later, Officer Billy Womack arrived in the mortuary's office and witnessed Armstrong standing over Neal with a bloody knife.²⁵⁴

Although Officer Womack asked Armstrong what was wrong, Armstrong "just stared at him," ignored his request, ascended a stairway as other officers arrived, and descended the stairway back to the office again.²⁵⁵ With Officer Womack and the other officers watching, Armstrong decapitated Neal.²⁵⁶ "Grinning, [Armstrong] picked up the head by the ears and held it up for the officers to see."²⁵⁷ In Officer Womack's words, Armstrong "appeared to be a person possessed."²⁵⁸ After "put[ting] the head down, [Armstrong] picked up Rev. Neal's headless body and placed it in a chair, picked up the head, and walked upstairs and dropped it in the toilet."²⁵⁹ Then, when Armstrong returned downstairs, he set the knife in the briefcase and walked toward the entrance, never responding to the officers who admitted not feeling threatened by him despite his

250. 671 So. 2d 307, 308, 313 (La. 1996).

251. *Id.* at 308.

252. *Id.*

253. *Id.*

254. *Id.*

255. *Id.*

256. *Id.*

257. *Id.*

258. *Id.*

259. *Id.*

strange and violent behavior.²⁶⁰ The officers then arrested Armstrong for murder.²⁶¹

Evidence showed that Armstrong, also a minister, stabbed Neal more than twenty times, and that Neal died of a chest wound.²⁶² While initially a trial court found Armstrong incompetent to stand trial and ordered him institutionalized, he was later rendered competent.²⁶³ At trial, despite medical testimony from Armstrong's history and from experts, the jury accepted the narrative that Armstrong could distinguish between right and wrong based on the *M'Naghten* standard.²⁶⁴ According to the court, not only was Armstrong able to communicate with others before the killing, he may have been motivated by revenge.²⁶⁵ Indeed, as the prosecutor and a physician expert concluded, Armstrong behaved normally on the morning of the homicide, arguing that "even a paranoid schizophrenic in a psychotic state can know the difference between right and wrong."²⁶⁶

On appeal, however, a wide range of medical experts converged to offer a different narrative of Armstrong. They recounted Armstrong's vast numbers of disabilities in great detail—a "twenty-five year history of mental illness with delusions, auditory hallucinations, religious obsessions and occasional psychotic episodes, particularly when defendant was subjected to stress or failed to take his medication."²⁶⁷ Indeed, Armstrong, a veteran who had been "medically discharged from the service as a paranoid schizophrenic," had been admitted to mental institutions continuously between 1969 and 1992 and was released only three days before the killing of Neal.²⁶⁸ Most importantly, three psychiatrists and one psychologist insisted that Armstrong could not tell the difference between right and wrong when he killed Neal and that he was experiencing psychotic episodes.²⁶⁹ The court stressed Armstrong's violence and

260. *Id.*

261. *Id.*

262. *Id.*

263. *Id.*

264. *See id.* at 308-09; *see also supra* notes 109-11 and accompanying text.

265. *Armstrong*, 671 So. 2d at 309.

266. *Id.* at 308.

267. *Id.* at 312.

268. *Id.* at 308.

269. *Id.* at 312.

“extensive evidence of bizarre behavior, before and after the killing, which was consistent with conduct that has led to his numerous hospitalizations.”²⁷⁰ The court later rendered Armstrong insane.²⁷¹

Critical to Armstrong’s case were the numbers of unified experts and their capacity to link Armstrong’s mental illness to his behavior. For example, all experts who testified, including one state physician, agreed that the defendant suffered from paranoid schizophrenia.²⁷² In the court’s view, “the most significant evidence of ability to distinguish right from wrong in many insanity defense cases is evidence of the accused’s attempts to hide evidence of the crime,” which Armstrong did not do.²⁷³ Indeed, the court stressed that “the fact that defendant decapitated Rev. Neal in view of several police officers militates strongly against a conclusion that he knew he was doing wrong at the time.”²⁷⁴ Similar themes exist in the following case.

2. *Crime in Broad Daylight with No Attempt to Flee:*
State v. Currie

In *State v. Currie*, a jury convicted Robert Currie, a fifteen-year-old, of second degree murder for stabbing his mother twenty-four times and of second degree attempted murder for stabbing his friend while in New Orleans.²⁷⁵ Directly before the stabbings, Currie met up with friends interested in vampirism and the occult to drink alcohol, smoke marijuana, and take LSD.²⁷⁶ Afterwards, police found that Currie had cut his own wrists and used his blood to write messages on the victims’ hotel mirror.²⁷⁷ Currie’s friend and surviving victim, Gene Battistelli, testified that Currie heard voices the night before the crime and believed himself to be an immortal vampire.²⁷⁸ According to Battistelli’s testimony, on some occasions

270. *Id.*

271. *Id.* at 313.

272. *Id.* at 308.

273. *Id.* at 313.

274. *Id.*

275. 812 So. 2d 128, 129 (La. Ct. App. 2002).

276. *Id.* at 129-30.

277. *See id.* at 130-31.

278. *See id.* at 131.

he believed that Currie “might not know who he was,” and also that Currie said at times “that he wished he had a gun so that he could kill himself.”²⁷⁹ In addition, Battistelli thought that Currie “was acting strange ... because of the drugs.”²⁸⁰

At trial, several defense experts testified about Currie’s family history of mental illness and that Currie suffered from severe psychosis and schizophrenia for several years.²⁸¹ The State presented one rebuttal expert witness, Dr. Harminder Mallik, who agreed that Currie had a mental disorder but did not think the disorder rendered him to be “incapable of distinguishing between right and wrong.”²⁸² Mallik also determined that Currie suffered from hallucinogenic intoxication, but was otherwise sane.²⁸³

On appeal, the Court of Appeal of Louisiana reversed the conviction, finding that the facts of the case did not support Dr. Mallik’s assessment.²⁸⁴ The court stated that it could not “imagine a case wherein an insanity defense could possibly be more strong.”²⁸⁵ Currie was a victim of childhood trauma, had suffered brain damage at birth, was diagnosed with schizophrenia by age eleven, and had been off his antipsychotic medication for over one year before the murder.²⁸⁶ In addition, the facts of the crime were indicative of insanity: Currie “committed the crimes in broad daylight in front of many witnesses. He did not attempt to flee. He was found within minutes in a trance-like state. After admitting he had killed his mother, he asked for her comfort shortly thereafter.”²⁸⁷ The court stressed that “[t]hese do not appear to be the acts of a man who can distinguish right from wrong.”²⁸⁸ In dismissing Dr. Mallik’s testimony, the court explained that the expert’s “conclusion of hallucinogenic intoxication was based almost exclusively on interviews with the defendant who reported his own drug use to the doctor at a time when he was psychotic” and that “[t]here was

279. *Id.*

280. *Id.*

281. *See id.* at 131-34.

282. *Id.* at 134.

283. *See id.* at 138.

284. *See id.*

285. *Id.*

286. *Id.*

287. *Id.*

288. *Id.*

little corroboration of the history of his drug [use] by independent or objective sources.”²⁸⁹

As with the *Armstrong* case, Currie’s extreme violence, committed publicly with no attempt to hide, appeared most convincing to the court. Likewise, the State introduced only one expert who had not employed any neuroscientific measures or otherwise “independent or objective sources” to verify his conclusions.²⁹⁰

3. *Juvenile Committing Patricide: People v. Baker*

In *People v. Baker*, the defendant, Kenneth Baker, shot and killed both of his parents in their home and confessed while at a police station.²⁹¹ According to Baker, he got into an argument with his father and became upset.²⁹² Baker then retrieved a gun before saying to his father, “[t]he father dies before the son.”²⁹³ When his father moved toward Baker’s throat, Baker fired several shots until his father fell.²⁹⁴ Baker then shot and stabbed his mother and returned to his father to stab him again.²⁹⁵ Afterward, Baker got into his car to drive to Las Vegas, ultimately driving his car off a highway.²⁹⁶ Before he killed his parents, Baker was periodically hospitalized for psychiatric problems and—as evidenced by the testimony of his family and friends—exhibited bouts of erratic behavior.²⁹⁷ The trial court found Baker guilty but mentally ill, and he appealed.²⁹⁸

Four experts testified to Baker’s mental state,²⁹⁹ and there was a substantial consensus among them. A psychiatrist, Dr. Glenn Prentice, interviewed Baker, reviewed his records, and, based on this information, opined that Baker suffered from schizophrenia and was unable to appreciate the criminality of his behavior.³⁰⁰ Three other

289. *Id.*

290. *Id.*

291. 625 N.E.2d 719, 722 (Ill. App. Ct. 1993).

292. *Id.*

293. *Id.*

294. *Id.*

295. *Id.*

296. *Id.*

297. *See id.* at 723-24.

298. *See id.* at 726.

299. *Id.* at 724.

300. *Id.*

experts agreed with Dr. Prentice's assessment after interviewing Baker and reviewing his reports: a forensic psychiatrist, Dr. Matthew Markos, a clinical psychologist, Dr. Michael Rabin, and another medical expert, Dr. Albert Stipes, who, along with Dr. Rabin, worked at the county psychiatric institute.³⁰¹ All three experts stated that Baker suffered from a schizo-affective disorder and concurred with Dr. Prentice that "the difference present[ed] in the diagnoses [Dr. Prentice's "schizophrenia" vs. their "schizo-affective disorder" was] 'an academic one' and that it did not change the ultimate determination [of] insanity."³⁰² In addition, all four experts reached a consensus that Baker did not exhibit signs of malingering.³⁰³ Strikingly, no expert witness testified on behalf of the State.³⁰⁴

With this level of expert unity in mind, the court found that the trial court erred in rejecting the expert testimony and rendered Baker not guilty by reason of insanity.³⁰⁵ While the trier of fact may accept or reject expert testimony or rely on lay testimony, the court concluded that there was no basis to reject the expert testimony in this case.³⁰⁶ As the court emphasized, all experts relied substantially "on records of events shortly after the incident," all interviewed the defendant, and "[w]ithout exception, all of the experts concluded that defendant lacked the substantial capacity to appreciate the criminality of his conduct and could not conform his conduct to the requirements of law as a result of his mental disease or defect at the time of the crime."³⁰⁷ Likewise, all experts' conclusions were bolstered by Baker's "prior hospitalization for the same disease six months prior to the killings."³⁰⁸

301. *Id.* at 725-26.

302. *Id.* at 725.

303. *See id.*

304. *See id.* at 727.

305. *Id.* at 733.

306. *Id.* at 727.

307. *Id.* at 728.

308. *Id.* at 729.

4. *Attempted Murder of a Police Officer: Dixon v. State*

In *Dixon v. State*, a jury convicted the defendant, Brenda Ann Dixon, a forty-year-old practicing attorney in Tuscaloosa, Alabama, of attempted murder of a police officer and sentenced her to twenty years in prison.³⁰⁹ On appeal, the Court of Criminal Appeals of Alabama held “that the evidence of [the defendant’s] insanity was both overwhelming and uncontradicted,” overcame the presumption of sanity, and entitled her to an acquittal.³¹⁰ The court’s recital of the facts of this case provided a basis for the insanity defense.

On the day of the incident, a Sunday evening, Dixon was “walking down the median” of a Tuscaloosa boulevard when she encountered two police officers.³¹¹ One officer stated that Dixon seemed “to be very paranoid, thinking somebody was after her;” Dixon also did not believe they were police officers even though they were wearing uniforms.³¹² About an hour later, Dixon went to a convenience store and asked the manager to call the state troopers because she believed she was being followed.³¹³ She specifically told him not to contact the Tuscaloosa police.³¹⁴ The manager did as Dixon requested, but when the troopers informed him that he should call the police, he complied.³¹⁵ Upon hearing the manager’s phone call, Dixon left and went to a park while Officer Tina Williams arrived at the store.³¹⁶ The store manager conveyed to Officer Williams that Dixon “looked ‘spaced out’ and was ‘acting very strange,’” and the police radio dispatch had characterized Dixon as “an [u]nwanted guest acting crazy.”³¹⁷ Officer Williams then went to the park to offer Dixon assistance, but Dixon “jumped out from behind the trees, made a ‘karate kick sound,’ and charged at Officer Williams,” knocking the officer down, then wrestling, kicking, and scratching her.³¹⁸ Dixon also managed to grab Officer Williams’s revolver from its holster

309. 668 So. 2d 65, 65-66 (Ala. Crim. App. 1994).

310. *Id.* at 71-73.

311. *Id.* at 66.

312. *Id.*

313. *Id.*

314. *Id.*

315. *Id.*

316. *Id.*

317. *Id.* (alteration in original).

318. *Id.*

and point it at the officer's chest, at which point Officer Williams knocked it away.³¹⁹ However, the weapon discharged and caused Officer Williams a scalp injury, nearly missing a shot through her head.³²⁰ One day later, doctors evaluated Dixon and diagnosed her "as suffering from 'delusional disorder, persecutory type.'"³²¹ The trial court declared her incompetent to stand trial; however, she was later treated and restored to competency.³²²

During the appeal, the prosecution argued that Dixon's "paranoia on the night of the offense was caused by her ingestion of Valium and diet pills,"³²³ a claim strongly countered by the defense who characterized the defendant's mental illness as a delusional disorder exacerbated by substance abuse³²⁴ and introduced into the record the results of a CT scan.³²⁵ While the defense's expert presumably used the scan to form the diagnosis of psychotic delusional disorder, the court did not discuss the scan's exact results.³²⁶ Nonetheless, the court found the defense expert's testimony reliable, as it was based "on psychological tests, a social and family history, 'a CT scan' of [Dixon's] brain, a drug screen, and voluminous records outlining the nearly identical conclusions of four other mental health professionals."³²⁷

According to the defense expert, Dixon "really thought she was in danger" from Officer Williams and was convinced that her actions were appropriate and necessary.³²⁸ The court emphasized the importance of such expert testimony, noting that "[a]lthough expert opinion is not binding on the jury and may be rejected, 'it may not be arbitrarily ignored, and some reason must be objectively present for ignoring expert opinion testimony.'"³²⁹ In addition, "the State's own evidence belied any theory that [Dixon] was functioning within

319. *Id.*

320. *Id.*

321. *Id.*

322. *Id.* at 66-67.

323. *Id.* at 72.

324. *Id.*

325. *Id.* at 67-68.

326. *Id.* at 68.

327. *Id.* at 71-72.

328. *Id.* at 68.

329. *Id.* at 70 (quoting *United States v. Hall*, 583 F.2d 1288, 1294 (5th Cir. 1978)).

a ‘lucid interval’ on the night in question.”³³⁰ Ultimately, the court deemed the defendant insane because, due to a severe mental disease, she could not appreciate the wrongfulness of her acts.³³¹ Evidence of the defendant’s insanity was “both overwhelming and uncontradicted” based on the defense expert’s testimony.³³²

As in the other cases, the defense expert here shaped the narrative about Dixon using multiple and comprehensive measures of Dixon’s mental state, including a CT scan. Such thoroughness was also strengthened substantially by the “nearly identical conclusions of four other mental health professionals.”³³³ This approach countered the possibility of a more damning narrative for Dixon given her drug use and attempt to murder a police officer—features that could quickly come to the fore in other cases in which experts may not agree.

5. *Going to Heaven: People v. Wilhoite*

In *People v. Wilhoite*, a jury found the defendant, Deborah Wilhoite, guilty of the attempted murder of her nine-year-old daughter, and the court sentenced her to ten years in prison.³³⁴ Wilhoite appealed, arguing that she proved by a preponderance of the evidence that she was insane.³³⁵

At trial, the parties agreed that, if Wilhoite’s nine-year-old daughter, Tiffany, were to testify, she would tell the court that on the evening of February 28, 1988, she saw Wilhoite attempt to throw her fourteen-month-old brother out of a window of their eighth-floor apartment while saying, “We have been saved and are going to heaven.”³³⁶ After her older sister, Ava, pulled her brother away from Wilhoite and sought safety, Wilhoite tried to throw Tiffany out of the window instead.³³⁷ Tiffany managed to hold onto a curtain until a neighbor intervened and pulled her back into the

330. *Id.* at 72.

331. *Id.*

332. *Id.* at 71.

333. *Id.* at 71-72.

334. 592 N.E.2d 48, 49 (Ill. App. Ct. 1991).

335. *Id.*

336. *Id.*

337. *Id.*

apartment unharmed.³³⁸ The Illinois Appellate Court considered the evidence presented at trial, including the testimony of three defense psychiatrists.³³⁹ All three experts agreed that Wilhoite was “unable to conform her behavior to the requirements of the law due to the condition of brief reactive psychosis.”³⁴⁰ In rebuttal, the State’s psychiatrist, Dr. Werner Tuteur, testified that Wilhoite was legally sane and under the influence of cannabis at the time of the incident.³⁴¹ Wilhoite reported that she smoked marijuana fifteen minutes before the incident and did not recall what transpired.³⁴² However, according to the defense, Wilhoite’s psychosis was not related to drug use but instead caused by a series of stressors, including financial difficulty and the current knowledge that her live-in boyfriend molested her daughter.³⁴³

The trial court found the State expert’s diagnosis of “voluntary cannabis intoxication caused by the frequency of the defendant’s use’ to be ‘more logical.’”³⁴⁴ Upon review of the available evidence, the appellate court disagreed, finding many foundational flaws in Dr. Tuteur’s diagnosis of voluntary intoxication, which “fatally undermine[d] his opinion that defendant was legally sane at the time of the offense.”³⁴⁵ Dr. Tuteur never attempted to ascertain how much marijuana Wilhoite smoked, which made “his opinion attributing defendant’s conduct to cannabis intoxication rather than to brief reactive psychosis ... untenable.”³⁴⁶ The evidence also showed that “the textbook source Dr. Tuteur professe[d] to use as guidance in diagnosing [Wilhoite’s] condition virtually negate[d] his conclusion and support[ed] those of defendant’s experts.”³⁴⁷ One defense expert, Dr. Robert Reifman, argued that Wilhoite used marijuana consistently for ten years and never before suffered an

338. *Id.*

339. *Id.* at 50.

340. *Id.*

341. *Id.* at 50-51. The state expert, Dr. Tuteur, conceded that he did not know exactly how much marijuana the defendant smoked before the incident. *Id.* at 51. Take note that the opinion itself wrongly spells Dr. Tuteur’s name as “Tutuer.” *Id.*

342. *Id.*

343. *Id.*

344. *Id.* at 52.

345. *Id.* at 54.

346. *Id.*

347. *Id.*

adverse reaction.³⁴⁸ The court agreed that the defendant's symptoms went far beyond the Diagnostic and Statistical Manual of Mental Disorders' definition of cannabis intoxication.³⁴⁹ Yet, Tiffany's testimony of her mother's comments regarding being saved and going to heaven on the night in question clearly established that Wilhoite suffered from delusion.³⁵⁰ Thus, the appellate court reversed the conviction, finding that "the manifest weight of the evidence at trial established that it was more likely than not that defendant was insane at the time of the offense."³⁵¹

In different ways, each of these cases exemplifies how experts create a narrative of the defendant's behavior and how courts respond. The narrative for insanity cases must be particularly compelling for the defense because insanity is exceedingly difficult to prove. Because both the defense and the prosecution can devise a narrative, the "battle of the experts" can be crucial in determining a case's outcome. Courts are significantly influenced by a diversity of evidence and a consensus among experts. Thus, the defense's strongest approach is to eliminate the battle entirely, so that experts align in writing the defendant's insanity story. To the extent that neuroscientific evidence can help us promote this strategy allows us to imagine a fairer and more efficient future for law and neuroscience.

B. The Prosecution's Narrative

In insanity cases, prosecutors also have a narrative for the defendant, although it is harder to detect in successful cases because most are overwhelmed with the defendant's evidence. According to the results of the Twelve-Decade Neuroscience Study, one of the strongest arguments a prosecutor can make for rebutting defense evidence is that the defendant is malingering, that is, feigning or faking mental illness symptoms.³⁵²

348. *Id.* at 55.

349. *See id.*

350. *See id.* at 55-56.

351. *Id.* at 58.

352. *See* Seth Feuerstein et al., *Malingering and Forensic Psychiatry*, 2 PSYCHIATRY 25, 25-27 (2005).

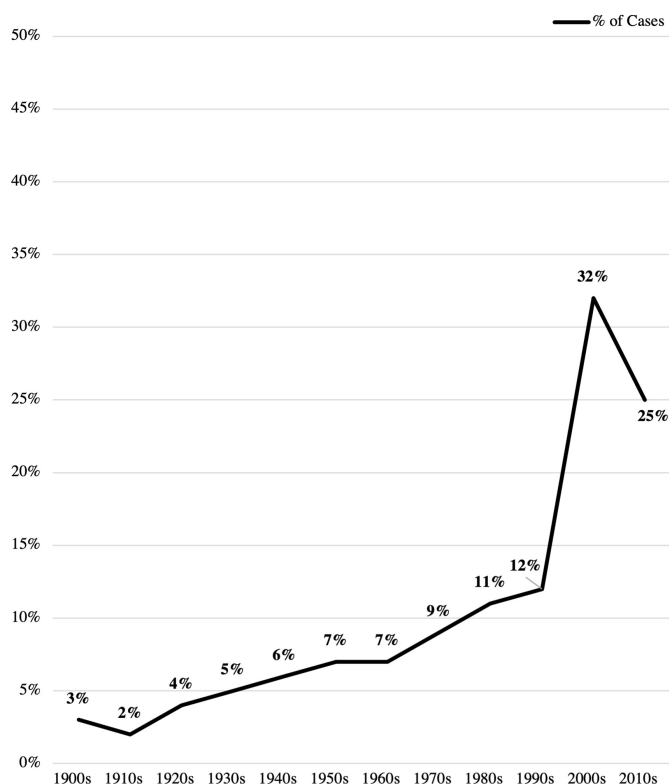
1. Evidence of Defendant's Malingering

As The Study's Figure 7 shows, over time, malingering issues in insanity cases have increased dramatically—from 3 percent (3 cases) in the 1900s to 25 percent (45 cases) of insanity cases in the 2010s.³⁵³ In the 2000s, such cases rose as high as nearly one-third (32 percent) of all insanity cases. This eight-to-ten-fold increase is telling about prosecutorial approaches in insanity cases; yet, the incline could also generally impact the use of neuroscientific evidence in court, irrespective of its purpose. For example, false determinations of malingering can potentially cause “adverse outcomes, such as denial of treatment or offense enhancement,” effectively controverting the overarching goals of the criminal justice system.³⁵⁴

353. *See infra* Figure 7.

354. *See generally* Mary Alice Conroy & Phylissa P. Kwartner, *Malingering*, 2 APPLIED PSYCH. CRIM. JUST. 29, 29-32 (2006).

Figure 7. Percentage of Insanity Defense Cases in Which Malingering Was an Issue from 1900-2020: 3,300 Total Cases³⁵⁵



What is “malingering” in the context of psychiatric diagnoses and insanity cases? The American Psychiatric Association provides some guidance in the Association’s Diagnostic and Statistical Manual of Mental Disorders (DSM-V).³⁵⁶ While controversial, the DSM “is often referred to as the psychiatric profession’s diagnostic Bible.”³⁵⁷ The

355. In Figure 7, the total number of insanity cases where malingering was an issue between 1900 and 2020 is 338. The breakdown per decade is as follows: 1900s-3 cases, 1910s-2 cases, 1920s-5 cases, 1930s-7 cases, 1940s-10 cases, 1950s-20 cases, 1960s-31 cases, 1970s-49 cases, 1980s-94 cases, 1990s-27 cases, 2000s-47 cases, 2010s-45 cases. See Statistical Appendix, at 360-63 (on file with author).

356. AM. PSYCHIATRIC ASS’N, DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS 726 (5th ed. 2013).

357. See Grant H. Morris & Ansar Haroun, “God Told Me to Kill”: Religion or Delusion?,

DSM-V also offers an official definition of malingering that courts and professionals commonly reference and that many experts use when evaluating defendants.³⁵⁸ According to the DSM-V, “[t]he essential feature of malingering is the intentional production of false or grossly exaggerated physical or psychological symptoms, motivated by external incentives such as avoiding military duty, avoiding work, obtaining financial compensation, evading criminal prosecution, or obtaining drugs.”³⁵⁹

The DSM-V also states that malingering should be strongly suspected if any combination of the following is noted when examining the patient:

- (1) Medicolegal context of presentation (e.g., the individual is referred by an attorney to the clinician for examination);] ...
- (2) [m]arked discrepancy between the individual’s claimed stress or disability and the objective findings[;] ...
- (3) [l]ack of cooperation during the diagnostic evaluation and in complying with the prescribed treatment regimen[;]
- (4) the presence of antisocial personality disorder.³⁶⁰

As The Study showed, on rare occasion, defense experts will identify a defendant’s malingering; however, the prosecution makes the argument nearly exclusively. A finding of malingering can be very persuasive and can sometimes affect the court’s judgment.³⁶¹ Indeed, testifying experts have stressed that “[a]n inaccurate diagnosis of malingering by an expert does a major disservice to justice” because it can wrongly result in longer sentences.³⁶² Likewise, the

38 SAN DIEGO L. REV. 973, 1023 (2001) (internal quotations omitted).

358. See Feuerstein et al., *supra* note 352, at 25.

359. AM. PSYCHIATRIC ASS’N, *supra* note 356, at 726.

360. See *id.* at 727.

361. See *Bench v. State*, 431 P.3d 929, 976 (Okla. Crim. App. 2018) (finding that, because several defense experts and various tests confirmed malingering, the outcome of the case would not have been different had the defendant been afforded the opportunity to call one of his experts for surrebuttal); see also *State v. Rojas*, 592 N.E.2d 1376, 1383 (Ohio 1992) (concluding that the defendant was malingering, which led the court to determine an expert’s diagnosis of mental retardation to not be credible).

362. James L. Knoll IV & Phillip J. Resnick, U.S. v. Greer: *Longer Sentences for Malingerers*, 27 J. AM. ACAD. PSYCHIATRY & L. 621, 624 (1999).

legal implications of malingering are severe: “such a diagnosis should not be made unless there is a high degree of certainty.”³⁶³

2. *Implications of Malingering*

The Study shows that, even though malingering was infrequently brought forth in early twentieth-century insanity cases, courts still allowed such evidence into testimony, thus setting the foundation for modern arguments.³⁶⁴ In *People v. Krauser*, for example, experts disagreed regarding whether the defendant was insane or feigning symptoms of insanity.³⁶⁵ The defendant, Walter Krauser, was one of the only two defendants to undergo what then mimicked brain imaging in The Study’s earliest decades.³⁶⁶ Defense experts took “[r]adio pictures” of Krauser’s skull that showed a “thickening over the back of the occipital bone, encroaching somewhat upon the space that should be occupied by the part of the brain known as the cerebellum.”³⁶⁷ Krauser also underwent a range of mental and psychological tests.³⁶⁸ Based on these tests, the defense expert concluded that Krauser was “of subnormal—of feebleminded—intelligence” and had the mental age of an eight-year-old.³⁶⁹ According to two doctors who testified for the State, Krauser was not feebleminded or insane and was, in fact, feigning his insanity.³⁷⁰ The court ultimately reversed Krauser’s conviction based on an improper jury instruction on insanity, concluding that Krauser “had a right to have his case submitted to the jury on the evidence introduced in the case” and was “entitled to have the jury accurately instructed” on the insanity issue.³⁷¹ Krauser also benefitted from having a defense team that gathered an enormous amount of family history and medical information, thus validating his conditions and behaviors.

363. *Id.*

364. *See supra* Figure 7.

365. 146 N.E. 593, 596 (Ill. 1925).

366. *See* Statistical Appendix, at 349 (on file with author).

367. *Krauser*, 146 N.E. at 596.

368. *See id.* at 596-97.

369. *Id.*

370. *Id.* at 599.

371. *Id.* at 606.

Yet, Krauser's case was an early outlier win against a prosecutor's malingering claim. The Study's last three decades of cases tell a different story. As Figure 7 shows, malingering appeared in over one-fifth of insanity cases from 1990 to 2020 and served as a common basis for rejection of defendants' insanity defenses.³⁷² For example, in *People v. Stack*, the testimony of malingering and general disagreement among experts regarding the defendant's actual mental condition led the appellate court to accept the trial court's rejection of the defendant's insanity defense.³⁷³ The State called a clinical psychologist, Dr. Linda Grossman, who testified that the defendant's various psychological test results were consistent with malingering and that the defendant exaggerated symptoms of a mental disorder.³⁷⁴ One other State expert, Dr. Henry Lihmeyer, agreed, emphasizing that the defendant's alleged delusions were untruthful.³⁷⁵ This evidence strongly affected the trial court: "I find that [the defendant] is a manipulator. He has fooled some of the examiners and used his skills as a malingerer and a manipulator in an attempt to avoid responsibility for his actions."³⁷⁶ Holding that the State met its burden of proof, the court rendered the defendant guilty of first degree murder for the murder of his wife and son.³⁷⁷

Predictably, efforts to prove malingering will be a powerful prosecutorial tactic in the future, given its increasing use over 120 years.³⁷⁸ While the criminal justice system wants of course to find truth, defendants face serious repercussions when confronted by an erroneous malingering claim. Such a strategy also plays into our worst fears about how neuroscientific techniques can be used in dubious ways.³⁷⁹ Without The Study's research results, we would not be aware of the speed and significance of malingering tests, especially given the spotlight placed on brain imaging. With data

372. See *supra* Figure 7.

373. 724 N.E.2d 79, 88-89 (Ill. App. Ct. 1999).

374. *Id.* at 85.

375. See *id.*

376. *Id.* at 86.

377. *Id.*

378. See *supra* Figure 5.

379. See Conroy & Kwartner, *supra* note 354, at 32.

comes the foresight to prepare for a future with law and neuroscience and all that such a combination may bring.

CONCLUSION

The past foretells our future, or so the story goes. Progress in neuroscience has enabled experts to create intricate narratives about the defendants they are testifying for or against in their battles, while also allowing courts to peer into defendants' brains and minds. Even as these technologies develop, the criminal justice system will still heavily rely on narratives crafted by expert testimony, as we have seen from the past 120 years.³⁸⁰

While experts will always be the essential interpreters of all things neuroscience, perhaps we should think differently about them as we head into the future. We know experts are not always accurate with their courtroom stories. Much like the Phineas Gage case, there is a risk of narrative misdirection. Imagining a future of law and neuroscience is recognizing that adversarial models in law and science will perpetuate divisiveness until both systems can take on an alternative—more unified—transformation.

Can neuroscientific advances help history from repeating itself with more precise, objective, and verifiable creations? If so, criminal justice experts may find an interpretative consensus more readily. And reaching that goal may be one of the neuroscience profession's most outstanding achievements.

380. See Statistical Appendix, at 265-336 (on file with author).

APPENDIX A

I. RESEARCH METHODOLOGY: CASE SEARCHES, THE CODING
PROCESS, AND CODING INSANITY*A. Case Searches*

My Twelve-Decade Neuroscience Study involved examining 8,358 criminal law cases addressing neuroscientific evidence in any capacity from January 1, 1900, to December 31, 2020. These cases were systemically collected from the Westlaw and Lexis legal databases. This Twelve-Decade Neuroscience Study is an expansion of my comparable Two-Decade Neuroscience Study of every criminal case that addressed neuroscientific evidence from 1992-2012.³⁸¹ I expanded the Two-Decade Neuroscience Study to twelve decades to acquire a larger sample size and more opportunities to investigate time trends. Thus, while the methodologies for both my two-decade and twelve-decade studies are similar, this Appendix focuses on my Twelve-Decade Neuroscience Study.

Case searches for the Twelve-Decade Neuroscience Study (“The Study”) were conducted in phases by two research attorneys highly experienced in law and neuroscience and who shared the same techniques and strategies. I refer to these attorneys as “Research Attorney One” and “Research Attorney Two.” To create a dataset for The Study, both research attorneys conducted extensive searches of Westlaw and Lexis to find all neuroscience-related criminal law cases. The objective of these searches was to collect all criminal cases from January 1, 1900, to December 31, 2020, in which courts considered neuroscientific evidence in some way. Neuroscientific evidence was operationally defined according to search terms pertaining to a defendant or a victim in a case.

381. For a discussion of this Two-Decade Study, see generally Denno, *supra* note 29, at 500-501 (detailing the variables and methodology for the Two-Decade Study). Nearly a dozen articles and book chapters, as well as a forthcoming book, stem from the Two-Decade Study.

1. Search Terms

Research Attorney One and Research Attorney Two searched reported cases for both state and federal courts, thereby creating a dataset that included every relevant case in the country. The attorneys used three sets of search terms. The first set of search terms, which pertained to neuroimaging, targeted specific types of commonly used brain scans mentioned in close proximity to terms relevant to “neuro” or any reference to the brain. This search took the following format: (neuro! or brain /250) and (MRI or fMRI or “PET scan” or “CT scan” or “CAT scan” or SPECT or EEG or BEEM or BEAM or “brain fingerprinting”).

The second set of search terms targeted cases in which expert witnesses discussed neuroscientific evidence. The strategy recognized that expert witnesses in the medical or neuroscientific fields would appear in close proximity to their credentials. It employed the following search construction: (neuro! /200 Dr.), (psych! /200 Dr.), (neuro! AND mental), (mental AND psych!), (brain /200 neuro!), (brain /200 psych!), (Dr. AND mental), and (mental AND expert). For cases decided before 1960, Research Attorney One conducted additional searches containing period-specific terms. For example, experts in earlier decades were called “alienists,” a term not applied in later decades. Thus, these additional terms included the following: (physician AND expert), (physician AND insan!), (alienist AND insan!), and (alienist AND mental).

The third set of search terms targeted criminal cases where ineffective assistance of counsel claims were based on defense attorneys’ failures to investigate, develop, or present neuroscientific evidence relevant to the defendant. These searches used the following terms: ((effectiv! or ineffectiv!) /3 assist!) /250 (neuro! or brain or MRI or “magnetic resonance imaging” or “PET scan” or “positron emission tomography” or “CAT scan” or “CT scan” or fMRI or BEAM or “brain fingerprinting” or EEG or SPECT).

The research attorneys conducted these searches for each of the twelve decades, then applied Westlaw filters to narrow the cases based on three criteria. All cases had to be (1) reported, (2) classified as criminal or habeas corpus, and (3) decided between January 1 of the first year of the decade and December 31 of the last year of the

decade being searched. Westlaw filters enabled the exclusion of cases already collected, thereby preventing duplicates in subsequent searches. After the research attorneys implemented all filters, they downloaded the case list in a Microsoft Excel (CSV) format.

Once saved, the research attorneys reviewed each case list to delete irrelevant cases. This process included removing a sizable number of noncriminal cases that somehow made it through the “criminal or habeas corpus” Westlaw filters. Once the research attorneys appropriately revised the list, they searched each case on the Westlaw list to review its relevancy further and weed out false positives. After that, the attorneys created a case list for each decade in Microsoft Word and systematically distributed the cases to law school research assistants for hand-coding. In total, these case searches yielded 8,358 neuroscience cases, all of which are included in The Study.³⁸²

2. Criteria for Relevancy

Set criteria established whether The Study would include a particular case. A court must have announced a disposition in a case where a party either introduced or sought to introduce neuroscientific evidence at any point in the proceeding (for example, innocence-or-guilt phase, penalty phase, post-conviction hearing, evidentiary hearing, et cetera). The Study only included cases in which neuroscientific evidence was introduced post-trial if the court took action based on that evidence. Such action could include granting an evidentiary hearing, finding ineffective assistance of counsel, or finding prior court error for failure to admit the evidence. For example, The Study contains several post-conviction cases where a defendant had been sentenced to death and was also arguing an ineffective assistance of counsel claim.

The Study’s case search did not include individual briefs, expert reports, or similar documents, because these materials are not available for all cases in either the Westlaw or Lexis databases. If multiple phases of the same case appeared in a search, research attorneys included only the most recent case opinion, regardless of

382. *See supra* Figure 1.

its phase. Also, if multiple defendants were tried in the same case, researchers coded only for the defendant(s) to whom the neuroscientific evidence applied.

B. The Case Coding Process

1. General Case Coding

All of The Study's cases were hand-coded (that is, coded by a person rather than a machine). This approach captured the vast legal, scientific, and factual variability existing in these cases and therefore ensured greater precision. Coding cases thoroughly and accurately was critical to The Study's reliability and validity.

Research Attorney One was primarily responsible for supervising J.D. student research assistants for the case coding. Case coding is a data collection method that requires a J.D. student to read an assigned criminal case carefully and then input information into various categories within a Microsoft Excel document. This coding scheme provided general facts and data for each relevant case and enabled researchers to systematically tabulate the specific neuroscientific evidence presented. In sum, the coding process required a J.D. student research assistant to read the case opinion in full and fill out a document designed for coding with information specific to each case opinion.

For my Two-Decade Neuroscience Study, a template was created in 2012 in Microsoft Excel entitled, "The Neuroscience Coding Template—General." The document was revised in 2019 and again in 2020 to accommodate the ten added decades constituting my Twelve-Decade Neuroscience Study. Thus, J.D. student research assistants used the 2020 version of "The Neuroscience Coding Template—General" to code each of the 8,358 cases in my Twelve-Decade Neuroscience Study.

In addition to neuroscientific evidence, other data were critical to The Study, such as a case's procedural history, court decision and holding, defenses, and more. The Study's Coding Template was organized into twelve different sections, outlined as follows: (1) Case

Name/Identifier,³⁸³ (2) Basic Case Information,³⁸⁴ (3) Sentencing,³⁸⁵ (4) Funding for Neuroscientific Evidence and Testimony,³⁸⁶ (5) Future Dangerousness,³⁸⁷ (6) Malingering,³⁸⁸ (7) Ineffective Assistance of Counsel,³⁸⁹ (8) Brain Scans,³⁹⁰ (9) Purpose of Neuroscientific Evidence,³⁹¹ (10) Findings By Medical Professionals,³⁹² (11) Other Relevant Evidence,³⁹³ and (12) Comments.³⁹⁴

383. *Case Name/Identifier*: This section includes the full case citation and identifies the case by its date and jurisdiction.

384. *Basic Case Information*: This section lists basic facts about each case, such as the case's procedural history or whether neuroscientific evidence was related to the defendant, victim, witness, convicted crimes, or the holding.

385. *Sentencing*: This section specifies the defendant's sentence.

386. *Funding for Neuroscientific Evidence and Testimony*: This section pertains to all information relating to funding requests, such as the type of evidence for which funding was requested, whether funding was granted or denied, and other relevant details.

387. *Future Dangerousness*: This section concerns details relating to the defendant's future dangerousness, such as whether neuroscientific evidence was used to support such a finding or there existed claims of ineffective assistance of counsel.

388. *Malingering*: This section includes details related to a finding or suspicion of malingering, such as whether the finding affected the court's judgment or was supported by expert testimony. The section also noted the particular ailment the defendant was purportedly feigning, and whether a psychological test actually revealed malingering.

389. *Ineffective Assistance of Counsel*: This section focuses on details related to a claim of ineffective assistance of counsel, including the basis for such a claim and whether the claim was accepted or denied.

390. *Brain Scans*: This section is separated into six different sections: (1) Stage at Which Brain Scan was Performed, (2) Type of Brain Scan (for example, MRI, EEG, or CT/CAT Scan), (3) Introducing Party (defense or State), (4) Brain Examined (Defendant or Victim), (5) Brain Scan Details (including whether the brain scan was accepted or denied as evidence), and (6) Brain Scan Findings (including findings such as brain damage and brain abnormality).

391. *Purpose of Neuroscientific Evidence*: This section specifies what type of defense or claim neuroscientific evidence was used to support. Examples include insanity, diminished capacity, incompetency, mitigation, or the extent of a victim's injuries.

392. *Findings by Medical Professionals*: This section outlines the findings of medical experts, including evidence of a defendant or victim's brain damage, mental illness, mental impairment, or neurological disorders.

393. *Other Relevant Evidence*: This section pertains to various findings presented by medical experts, lay witnesses, the defendant's testimony, or other sources. Such findings include indications of a defendant's substance abuse, childhood trauma, behavioral or emotional problems, and developmental issues, in addition to details related to non-imaging testing.

394. *Comments*: This section provides a detailed description of the court's decision and holding and other relevant evidence not specified in prior categories. It also includes coders' comments regarding identified trends, interesting facts, and unusual circumstances.

2. Training Coders

Over seventy-five J.D. student research assistants have worked as coders since 2012 at Fordham Law School. Most coders participated in the Two-Decade Neuroscience Study, and about twenty others have participated in the Twelve-Decade Neuroscience Study.³⁹⁵ Research Attorney One was responsible for training all coders in the Twelve-Decade Neuroscience Study and many coders in the Two-Decade Neuroscience Study.

Each year, Research Attorney One holds a three to five-day training session for Fordham student research assistants working as coders. For this purpose, Research Attorney One uses a forty-page manual that details the coding process. Student coders are assigned in rotating pairs to code and then compare their coding of the same cases to build inter-rater reliability. Research Attorney One then personally checks and reviews the accuracy of every coding sheet a student submits and makes any necessary edits. Research Attorney One and this author also communicate with each coder throughout the day and answer questions. Students code in pairs until Research Attorney One and this author believe their work is consistently accurate; then, they can code alone. Some coders have worked with us throughout their law school education.

C. Coding Insanity Cases

1. General Coding

The results of the general coding for all cases in The Study cases, as just described, can also be used for more specific and in-depth coding projects. For example, for this Article's neuroscience and insanity defense project, Research Attorney One identified cases in the general coding list that contained an insanity defense or issue for the last three decades: 1990-2020. Fordham J.D. student research assistants then coded these cases separately and more thoroughly using a new coding template.

395. The names of the coders are on file with the author.

More specifically, Research Attorney One identified a total of 550 cases involving an insanity defense or issue between January 1, 1990, and December 31, 2020.³⁹⁶ Research Attorney One then assigned these cases for coding. As with all coding, Research Attorney One carefully reviewed each student's work and made any necessary edits. After the coding was complete, Research Attorney One combined the students' coding documents into one Excel document entitled, "Final Neuroscience Coding: Insanity 1990-2020." Once combined, Research Attorney One conducted a final review to ensure that all cases were relevant and all data were accurate. The "Final Neuroscience Coding: Insanity 1990-2020" document serves as the basis for the various charts and empirical evidence this Article analyzes.

For the neuroscience and insanity defense project, coders relied on a template entitled, "Neuroscience Coding Template: Insanity 1990-2020." In contrast to "The Neuroscience Coding Template—General," this more tailored template included categories specific to the insanity defense. For the purposes of this Article's analyses, this insanity-specific document included twelve different categories broken down as follows: (1) Case Name/Identifier,³⁹⁷ (2) Insanity Issue,³⁹⁸ (3) Insanity Test,³⁹⁹ (4) Basis for Insanity Claim,⁴⁰⁰ (5) Neuroscientific Evidence Related to Insanity,⁴⁰¹ (6) Type of Expert Used to Support or Refute Insanity Defense,⁴⁰² (7) Type of Neuroimaging

396. See *supra* Figure 2.

397. *Case Name/Identifier*: This section includes the full case citation and identifies the case by its date and jurisdiction.

398. *Insanity Issue*: This section lists the type(s) of insanity issues present in each case, including, for example, whether the defendant argued an insanity defense or whether an insanity defense should have been presented.

399. *Insanity Test*: This section provides each type of insanity test used or referenced in each case, for example, *M'Naghten* or the ALI Model Penal Code.

400. *Basis for Insanity Claim*: This section indicates what evidence served as the basis for the defendant's insanity claim. Examples include evidence of a mental illness or neurological disorder, brain damage, and poor intellectual functioning.

401. *Neuroscientific Evidence Related to Insanity*: This section details the type(s) of neuroscientific evidence that was presented in connection with an insanity claim, including expert testimony, brain imaging, and non-imaging tests.

402. *Type of Expert Used to Support or Refute Insanity Defense*: This section specifies the type(s) of experts that was used by the defense and/or prosecution either to support or refute an insanity defense, including psychiatrists, psychologists, neurologists, physicians, radiologists, and more.

Used to Support or Refute Insanity Defense,⁴⁰³ (8) Type of Non-Neuroimaging Testing Used to Support or Refute Insanity Defense,⁴⁰⁴ (9) Opposition to the Insanity Defense and Challenges to Admissibility,⁴⁰⁵ (10) Other Claims Related to the Insanity Defense,⁴⁰⁶ (11) Court Decision and Outcome,⁴⁰⁷ (12) Comments.⁴⁰⁸ In the future, I plan to conduct an extensive analysis of the remaining 2,750 pre-1990s insanity cases using the same empirical approach.

2. *Successful Insanity Case Coding*

In order to identify the successful insanity cases among the 550 insanity cases from 1990-2020, Research Attorney One reviewed the Court Decision and Outcome section within the “Final Neuroscience Coding: Insanity 1990-2020” coding sheet for each case. Whenever

403. *Type of Neuroimaging Used to Support or Refute Insanity Defense*: This section lists the type(s) of brain imaging tests used by the defense and/or prosecution either to support or refute an insanity defense, including MRI, EEG, CT/CAT Scan, PET, and SPECT.

404. *Type of Non-Imaging Testing Used to Support or Refute Insanity Defense*: This section identifies the type(s) of non-imaging tests used by the defense and/or prosecution either to support or refute an insanity defense, including the Minnesota Multiphasic Personality Inventory, the Wechsler Adult Intelligence Scale, the Rorschach Test, the Wide Range Achievement Test, and more.

405. *Opposition to the Insanity Defense and Challenges to Admissibility*: This section indicates any opposition the defendant faced using the insanity defense and any challenges to admissibility the defendant experienced concerning insanity-related evidence. Example categories include the following: rejection of the defendant’s neuroimaging or non-imaging test results; State expert testimony supported a finding of sanity; a finding of malingering on behalf of the defendant was determined or suspected; and the court denied the defendant’s request for hiring an expert to support the insanity claim.

406. *Other Claims Related to the Insanity Defense*: This section details other claims made by the defendant that were related to the insanity defense. Examples include an insanity-related ineffective assistance of counsel claim, an insanity-related *Ake* claim, a defense argument that the insanity test or jury instruction was inadequate, and the defense’s contention that the prosecutor’s conduct relating to the insanity defense was improper.

407. *Court Decision and Outcome*: This section specifies the court’s decision relating to the defendant’s insanity claim and the case outcome. Examples include the court: accepting or rejecting the defendant’s insanity defense, determining that the defendant’s insanity-related ineffective assistance of counsel claim was either accepted or denied, concluding that the defendant was either entitled or not entitled to an insanity instruction, finding the jury instruction on insanity was either adequate or inadequate, and more.

408. *Comments*: This section provides a detailed description of the court’s decision and holding and the insanity-related holding. It also includes other relevant evidence not specified in prior categories, such as coders’ comments regarding identified trends, interesting facts, and unusual circumstances.

a court ruled in favor of the defendant in a way that related to the defendant's insanity defense, Research Attorney One copied and pasted the coded case in its entirety into a new coding sheet entitled, "Successful Insanity Coding Sheet 1990-2020." After reviewing all 550 cases, 86 cases were identified as being successful.

Once all eighty-six successful cases were identified, Research Attorney One reviewed each case to further categorize the reasons for success. This review process consisted of reading the coded information within the "Successful Insanity Coding Sheet 1990-2020" coding sheet as well as looking up and reviewing each case opinion on Westlaw. After each case was properly reviewed, the case was further organized into one or more of six non-mutually exclusive categories. These categories are as follows: (1) Insanity Cases Successful Due to Acceptance of Ineffective Assistance of Counsel Claim, (2) Insanity Case Successful Due to Acceptance of *Ake* Claim, (3) Insanity Case Successful Due to Finding of Court Error, (4) Insanity Case Successful Due to Finding of Prosecutor Error, (5) Insanity Case Successful Due to Determination that Defendant was Entitled to an Insanity Instruction or that Jury Instruction was Inadequate, and (6) Insanity Case Successful Due to Overwhelming Evidence of Insanity. These categories and their related case lists are contained within a Microsoft Word document entitled, "Types of Successful Insanity Cases 1990-2020."

There were twenty-three cases identified in list number six as insanity cases that were found to be successful due to overwhelming evidence of insanity. These twenty-three cases were thus labeled "pure insanity cases" given that the court in each case determined that the defendants were not guilty by reason of insanity. Research Attorney One copied and pasted these twenty-three coded cases in their entirety into a new coding sheet entitled, "Pure Insanity Coding Sheet 1990-2020" so further analysis could be performed.