6-25-2006

Neuroscience Evidence, Legal Culture, and Criminal Procedure

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American Journal of Criminal Law, Vol. 33, p. 301, 2006

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* Assistant Professor, University of Alabama School of Law. My thanks to Ronald Allen, Bill Brewbaker, Kimberly Ferzan, Dan Filler, Henry Greely, Harold Krent, Dennis Patterson, Rayman Solomon, Spencer Waller, and participants in faculty workshops at Rutgers School of Law-Camden, Alabama School of Law, and Loyola-Chicago School of Law for helpful comments on previous drafts; to Creighton Miller of the Bounds Law Library for help obtaining research materials; and to the editors of the American Journal of Criminal Law for their excellent editorial work.

I. Introduction

We humans at some point developed the biological complexity and linguistic skills necessary to lie and to deceive.[1] The ability to detect such acts reliably would undoubtedly be powerful evidence in any legal system interested in resolving contested factual disputes about the past in a reliable manner. The typical way to detect such conduct is with the evidence generated once people are ensnared by or forced into the tangled web they have chosen to weave, as it were. Some examples of these traps would include when a suspect utters statements that contradict reality, are internally inconsistent, or reveal details known only to the culprit, or when a suspect confesses because of guilt, to cease interrogation, or out of (mis)perceived self-interest.[2] Another way, which is now proposed by the next wave of lie-detection technology, would attempt to look for evidence at the neurological source of such conduct. Current neuroscience is investigating the possible neurological correlates of deceptive behavior, and the success of this research carries with it the promise of powerful legal evidence in the form of reliable lie detection.[3] Such a use, moreover, is one of several proposed uses of such evidence discussed in the legal literature. Others include predicting criminality,[4] and determining intentions and states of mind generally,[5] the voluntariness of acts,[6] the possible biases of judges and jurors,[7] and whether a person is brain dead.[8]

Despite these often sanguine-toned proposals, new types of evidence raise serious concerns for the law. One type of concern involves several related questions about the evidence itself. What is the nature of such evidence? What are its empirical limitations? What are its conceptual limi-

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1. One estimate is that deception emerged with primates about four million years ago. *See* Richard W. Byrne, *Tracing the Evolutionary Path of Cognition*, *in* THE SOCIAL BRAIN: EVOLUTION AND PATHOLOGY 43(Brüne et al. eds., 2003).

2. This may occur in various other ways; some examples include known deceptive behavior in similar circumstances and behavior perceived to indicate lying (no eye contact, nervousness, etc.). For details on the interrogation techniques employed to bring about these and the above circumstances, see GISLI H. GUDJONSSON, THE PSYCHOLOGY OF INTERROGATIONS AND CONFESSIONS: A HANDBOOK (2003).

3. The scholarly research is discussed in detail *infra* at pp. 9–16. For journalistic discussions, see Robin Marantz Henig, *Looking for the Lie*, N.Y. TIMES MAG., Feb. 5, 2006, at 22; Malcolm Ritter, *Brain Scans as Lie Detectors? AP's Lying Thief Checks It out*, DAILY CHRON., Jan. 28, 2006, http://www.daily-chronicle.com/articles/2006/01/29/news/news04.txt) (last visited July 27, 2006).

4. Henry T. Greely, *Prediction, Litigation, Privacy, and Property: Some Possible Legal and Social Implications of Advances in Neuroscience*, *in* NEUROSCIENCE AND THE LAW: BRAIN, MIND, AND THE SCALES OF JUSTICE 114, 120–23 (Brent Garland ed., 2004).

5. Erin Ann O'Hara, *How Neuroscience Might Advance the Law*, 359 PHIL. TRANSACTIONS: BIOLOGICAL SCIS., 1677, 1681–82 (2004).

6. Deborah W. Denno, *Crime and Consciousness: Science and Involuntary Acts*, 87 MINN. L. REV. 269, 320–37 (2002).

7. Greely, *supra* note 4, at 137–38; Brent Garland, *Neuroscience and the Law: A Report*, *in* NEUROSCIENCE AND THE LAW: BRAIN, MIND, AND THE SCALES OF JUSTICE, *supra* note 4, at 22–23.

8. Garland, *supra* note 7, at 23–24. *See also* Joseph J. Fins, *The Orwellian Threat to Emerging Neurodiagnostic Technologies*, AM. J. BIOETHICS, Mar.–Apr. 2005, at 56, 56–57. Although my focus throughout will concern lie-detection and prior-knowledge uses of such evidence, I will refer to other uses when relevant to the analysis.

tations? What may or may not be legitimately inferred from it? Will it fit within existing legal concepts and practices, and, if so, how? Or will it alter, undermine, transform, or destroy such practices, thereby causing a radical shift in legal culture? With regard to neuroscience evidence in particular, Henry Greely has noted that "the invention by neuroscientists of perfectly or extremely reliable lie-detecting or truth-compelling methods might have substantial effects on almost every trial and on the entire judicial system."[9]

A separate type of concern involves how such evidence is gathered. All (perceived) valuable evidence involves the potential for overzealous, and sometimes barbarous, evidence-gathering practices.[10] The Constitution places limits on such conduct generally, but it is not clear how the compelled gathering of the proposed neuroscientific evidence would fit with extant constitutional limitations.[11] More bluntly—when can the government force defendants (or suspects, or anyone for that matter) against their will to submit to a test that measures the workings of their brains for evidence of lies or deception? Would this be like compelling a blood test (and hence subject to the Fourth Amendment, but not the Fifth Amendment privilege against self-incrimination), or would it be more like being forced to testify (and hence subject to the privilege)?

Both types of concerns are not new ones in the area of lie detection.[12] The polygraph has prompted similar theoretical issues.[13] Concerns

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9. Greely, *supra* note 4, at 137.

10. The importance of confessions in early common-law courts, for example, led to the employment of torture as an epistemological device. *See* Eben Moglen, *The Privilege in British North America: The Colonial Period to the Fifth Amendment*, *in* THE PRIVILEGE AGAINST SELF-INCRIMINATION 109, 120 (1997). Other concerns raised by such evidence include privacy concerns outside of the context of criminal litigation such as privacy interests regarding medical or similar information the tests might reveal. The tests may reveal information about "personality traits, mental illness, sexual preferences or predisposition to drug addiction." Paul Root Wolpe et al., *Emerging Neurotechnologies for Lie-Detection: Promises and Perils*, AM. J. BIOETHICS, Mar.-Apr. 2005, at 39, 46. *But cf.* Harold J. Krent, *Of Diaries and Data Banks: Use Restrictions Under the Fourth Amendment*, 74 TEX. L. REV. 49, 77–99 (1995) (arguing that "reasonableness" should apply not only to the seizure of evidence but also to the uses of such evidence, particularly how it is used outside of the prosecution context). Similar privacy issues arise regarding the information collected in DNA tests, both inside and outside the criminal process. *See generally* PHILIP KITCHER, SCIENCE, TRUTH, AND DEMOCRACY (2001).

11. *See* Charles N.W. Keckler, *Cross-Examining the Brain: A Legal Analysis of Neural Imaging for Credibility Impeachment*, 57 HASTINGS L. J. 509, 555 n.142 (2006) ("Could [a defendant's] brain be scanned simultaneously, in the way he is now compelled to surrender a DNA sample? I admit this to be a difficult question, but one I think society will inevitably confront, and one well worth exploring in advance of this confrontation."); Richard G. Boire, *Searching the Brain: The Fourth Amendment Implications of Brain-Based Deception Devices*, AM. J. BIOETHICS, Mar.-Apr. 2005, at 62, 63 ("Existing Fourth-Amendment doctrine is incomplete and incoherent when applied to brain function.").

12. For early discussions of the appropriate and inappropriate uses of lie-detection technology, see Fred E. Inbau, *The Perversion of Science in Criminal and Personnel Investigations*, 42 J. CRIM. L., CRIMINOLOGY & P.S. 128 (1952), *reprinted in* 89 J. CRIM. L. & CRIMINOLOGY 1377, 1381–83 (1999); Fred E. Inbau, *Some Avoidable Lie-Detector Mistakes*, 40 J. CRIM. L. & CRIMINOLOGY 791 (1950), *reprinted in* 89 J. CRIM. L. & CRIMINOLOGY 1371 (1999).

13. The National Research Council's recent report highlights the concerns facing polygraph technology. *See* COMM. TO REVIEW SCIENTIFIC EVIDENCE ON THE POLYGRAPH BD. ON BEHAVIORAL, COGNITIVE, AND SENSORY SCIS. & COMM. ON NAT'L STATISTICS, DIV. OF BEHAVIORAL AND SOCIAL

about the disastrous effects that polygraph evidence may cause to the trial process, and to adjudicatory practices in general, have led some to question its admissibility on that ground.[14] A prominent proponent of this view is Justice Thomas, who in an opinion concluding that defendants do not have a constitutional right to present polygraph evidence, argued that lie-detection technology will usurp, or at least problematically diminish, the fact-finder's role in assessing credibility by causing undue deference to the machine and the technician.[15] For criminal procedure, appropriate concerns have been raised about compelling suspects to submit to polygraph examinations. For example, the Supreme Court's decision in *Schmerber v. California*, which held that compelled blood tests are not subject to the privilege against self-incrimination, questioned and expressed doubt as to whether the same logic should extend to polygraphs.[16] The perceived unreliability of polygraphs, however, has largely allowed courts to avoid dealing with these theoretical issues head on. Commentators also have largely refrained from attempting to resolve them.[17] Thus the uncertain reliability of polygraphs has provided a convenient excuse to bypass these issues and concerns.[18]

Reliable neuroscience-based lie detection, however, may force these issues back to the surface, and courts will have to resolve them. And they may have to do so soon. Neuroscience-based lie detectors are already being marketed for litigation purposes,[19] and two criminal defendants have already sought to introduce such evidence during post-conviction proceedings.[20] Assume that neuroscience evidence is shown to have sufficient and ascertainable reliability to satisfy admissibility standards, what then? Should it still be excluded because of how it may affect trial practices? Or should it be embraced for its potential to revolutionize those practices for the better? Regardless of admissibility, how will it affect constitutional

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SCIS. AND EDUC., NAT'L RESEARCH COUNCIL, THE POLYGRAPH AND LIE DETECTION (2003).

14. *See, e.g.*, D. Michael Risinger, *Navigating Expert Reliability: Are Criminal Standards of Certainty Being Left on the Dock?* 64 ALB. L. REV. 99, 129–30 (2000) (arguing that lie-detection evidence would have "drastic" effects on litigation).

15. United States v. Scheffer, 523 U.S. 303, 313–14 (1998).

16. 384 U.S. 757, 764 (1966).

17. *But see* Ronald J. Allen & M. Kristin Mace, *The Self-Incrimination Clause Explained and Its Future Predicted*, 94 J. CRIM. L. & CRIMINOLOGY 243, 249 (2004) ("[T]he universal intuition is that involuntary polygraphs violate the Constitution.").

18. Given the lack of a consensus regarding the reliability of polygraphs, courts have taken a variety of approaches with regard to their use as evidence. *See, e.g.*, United States v. Lea, 249 F.3d 632, 639–40 (7th Cir. 2001) (excludable under Rule 403 based on jury confusion); Cervantes v. Jones, 188 F.3d 805, 813 n.9 (7th Cir. 1999) (may not be relied on to determine probable cause), *overruled on other grounds by* Newsome v. McCabe, 256 F.3d 747, 751 (7th Cir. 2001); United States v. Posado, 57 F.3d 428, 433 (5th Cir. 1995) (rejecting rule that makes polygraph results per se inadmissible); United States v. Piccinonna, 885 F.2d 1529, 1536 (11th Cir. 1989) (admissible for impeachment purposes).

19. *See* No Lie MRI, Inc., http://www.noliemri.com (last visited July 27, 2006); Cephos Corporation, http://www.cephoscorp.com (last visited July 27, 2006) (claiming the technology is "90% accura[te] in clinical testing").

20. Slaughter v. State, 105 P.3d 832, 834–36 (Okla. Crim. App. 2005); Harrington v. State, 659 N.W.2d 509, 516 (Iowa 2003).

rights, even if only used as an investigative tool? Is it like a blood sample? Like testimony? Like both? Or like neither? How these questions are ultimately resolved could have significant consequences for both legal culture and the scope of constitutional rights. Thus the theoretical issues and concomitant concerns regarding this evidence have considerable practical significance.

This article addresses these issues and concerns. Although these are my primary focus, along the way I discuss ancillary issues such as the admissibility and the probative value of the proposed evidence. My thesis is that, when properly understood (an important qualification), there is nothing uniquely problematic about the proposed neuroscience evidence, and that its compelled production falls within core concepts and doctrines of both the Fourth Amendment and the Self-Incrimination Clause, and hence ought be regulated by them. By reflecting on both the evidence and our current practices, I will explain and help to clarify how the former may be assimilated into the latter.

Part II describes the preliminary neuroscience research on this issue. The research involves two different kinds of technology: experiments using fMRI tests to compare images of the brains of subjects during truthful and deceptive acts, in order to look for differences in areas of brain activation; and second, research using a technique referred to as "brain fingerprinting"[21] that uses EEG tests of brainwave responses when subjects are shown scenic images to measure whether prior familiarity with the image will elicit a different brain response than unfamiliarity.

Next, Part III provides conceptual understanding of the nature and significance of the proposed evidence. This understanding helps to clarify and evaluate if and how such evidence would fit with current legal concepts and practices. Limitations on the inferences this evidence can and cannot legitimately support will show how this evidence would not usurp the role of the jury and indeed may assist (rather than diminish) the jury in fulfilling its fact-finding functions. This evidence would not diminish the jury's role any more than other admissible evidence such as DNA random-match probabilities or expert testimony regarding false confessions or witness identifications. The neuroscience evidence would provide similar challenges (for example, improving juror understanding of it) but there is nothing qualitatively more problematic about the neuroscience evidence in these regards.[22]

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21. It is not clear why it is referred to as "brain fingerprinting" rather than, say, "brain printing." The metaphor is perhaps meant to suggest a similarity with fingerprint evidence because of the latter's frequent use in forensic contexts. If so, the metaphor may be less powerful given that fingerprint evidence may be less reliable than once thought. *See* Michael J. Saks & Jonathan J. Koehler, *The Coming Paradigm Shift in Forensic Identification Science*, 309 SCIENCE 892 (2005).

22. All scientific expert testimony raises challenges of juror understanding and the costs involved with connecting the scientific knowledge with juror understanding. Lie-detection evidence is not unique in this regard. There is an obvious practical difference in that lie-detection evidence would be relevant in a greater range of (perhaps all) cases—thus a practical difference may involve whether we as a society in general (or parties in particular cases) are willing to expend the costs to produce this evidence. Risinger, *supra* note 14, has suggested that these practical costs may be too great to allow for the admis-

To be sure, there are significant reasons to be skeptical about the proposed neuroscience evidence, and those reasons are discussed below; however, as with all expert testimony, the real issue should not be whether to admit or to exclude it *tout court* but to evaluate whether and when it can assist rational decision-making. This Part is aimed at analyzing the evidence in light of that goal.

Finally, Part IV analyzes and evaluates how compelling criminal suspects to submit to such tests would accord with constitutional criminal-procedure protections. In particular, this evidence is evaluated under the Fourth and Fifth Amendments. The analysis employs a theory and framework developed previously for evaluating claims that implicate both of these amendments.[23] Rather than diverging to protect different conduct or types of evidence, the Fourth Amendment and the Self-Incrimination Clause should be seen as overlapping to subject government evidence-gathering to a two-part inquiry: first, is it unreasonable (the Fourth Amendment inquiry),and second, if not unreasonable, does it seek to compel the incriminating content of the subject's mental states, such as the subject's beliefs or knowledge, to use against the subject in a criminal investigation or prosecution (the Self-Incrimination Clause inquiry)?[24] This evidence provides informative examples to test and extend that analysis. This Part will thus provide additional theoretical value in helping to understand the nature of the criminal-procedure protections discussed, most importantly, the privilege against self-incrimination.

II. Neuroscience Research

Although in its nascent stages, neuroscience research has made some progress in attempting to understand the brain processes that may be necessary for deceptive behavior.[25] Section A discusses this research. Section B discusses in a more cursory fashion a second type of neuroscience-based lie detection: a process known as "brain fingerprinting" that purports to reveal whether a suspect has prior knowledge of a particular scene or image. My purpose in this section is not to critique (or to endorse) the design of these studies or their conclusions. Rather, they are discussed to give the reader a sense of the underlying studies and their findings in order to better appreciate the conceptual issues discussed in subsequent sections.

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sibility of *any* lie-detection evidence. These practical issues with regard to the neuroscience evidence are beyond the scope of this article; they will have to be decided once the empirical and conceptual issues regarding this evidence have been worked out. The latter is the subject of this article.

23. Michael S. Pardo, *Disentangling the Fourth Amendment and the Self-Incrimination Clause*, 90 IOWA L. REV. 1857 (2005).

24. *See id.* at 1879–81. The above inquires, and alternative theories, are discussed *infra* at pp. 32–33, 36–53.

25. *See* sources cited *supra* note 3.

A. Deception

Recent experiments have used fMRI technology[26] to attempt to separate the neural correlates of truthful from deceptive behavior. The studies have revealed a general increase of activity in the prefrontal cortex during lies and deception.[27] The increased activity occurred in areas thought to control "executive functions" such as "problem solving, planning, the initiation and inhibition of behaviours, and the manipulation of useful data in conscious working memory."[28] By contrast, truthful responding has not been shown to be associated with any areas of increased activation.[29] In order to provide some background on the preliminary research underlying the proposed neuroscience-based evidence, this section discusses four published studies.[30] Three experiments attempted to measure in general truthful behavior versus lies or deception. The fourth attempted to further breakdown deceptive behavior according to variables such as whether they fit into a coherent story and whether they were previously memorized.

1. Spence et al. (2001)[31]

This study found evidence of "greater activity in[] [the] bilateral ventrolateral prefrontal cortices" during lying.[32] Ten subjects were asked 36 yes-no questions about their day (for example, whether they had made their bed).[33] They were then asked the same questions while in an fMRI

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26. Functional Magnetic Resonance Imaging "is based on the increase in blood flow to the local vasculature that accompanies neural activity in the brain." Functional MRI Research Center, Columbia University, About Functional MRI(General), http://www.fmri.org/fmri.htm (last visited Dec. 23, 2006). The test provides the following benefits over PET scans:

> The main advantages to fMRI as a technique to image brain activity related to a specific task or sensory process include 1) the signal does not require injections of radioactive isotopes, 2) the total scan time required can be very short, i.e., on the order of 1.5 to 2.0 min per run (depending on the paradigm), and 3) the in-plane resolution of the functional image is generally about 1.5 x 1.5 mm although resolutions less than 1 mm are possible. To put these advantages in perspective, functional images obtained by the earlier method of positron emission tomography, PET, require injections of radioactive isotopes, multiple acquisitions, and, therefore, extended imaging times. Further, the expected resolution of PET images is much larger than the usual fMRI pixel size. Additionally, PET usually requires that multiple individual brain images are combined in order to obtain a reliable signal.

Id.

27. Sean A. Spence et al., *A Cognitive Neurobiological Account of Deception: Evidence from Functional Neuroimaging*, 359 PHIL. TRANSACTIONS: BIOLOGICAL SCIS., 1755, 1760 (2004).

28. *Id.* at 1756.

29. *See id.* at 1760 ("So far, to our knowledge, no published fMRI study has revealed increased activation in any brain region during truthful responding . . . .").

30. For further discussion of these and other studies, see Keckler, *supra* note 11, at 524–37.

31. Sean A. Spence et al., *Behavioural and Functional Anatomical Correlates of Deception in Humans*, 12 NEUROREPORT 2849 (2001).

32. *Id.* at 2851.

33. For details of the study, see *id.* at 2849–50.

scanner, holding a device with buttons corresponding to "yes" and "no."[34] A screen in front of the subjects displayed a color, and the subjects were told to answer truthfully when one color appeared and to lie when another color appeared.[35] The authors then compared brain activity during truthful and lying responses. Lying responses exhibited increased activity in the prefrontal cortex, whereas truthful responses did not indicate any areas of increased activity.[36] The authors, however, note two important limitations to their initial findings: the details of the questions involved trivial matters and the stakes were low; emotional subjects and higher stakes may trigger different responses.[37]

2. Lee et al. (2002)[38]

This study attempted to measure "malingering"—"intentionally false and fraudulent simulation or exaggeration of physical or mental disease."[39] Six subjects underwent an fMRI test and were asked to feign a memory problem.[40] In particular, the subjects were told:

> You are to feign a memory problem and deliberately do badly on the test. Imagine a scenario, which envisages that a bad result will lead to an attractive sum of money as compensation for your memory problem. You should fake skillfully to avoid detection. So, your goal is to fake well, do it with skill, and avoid detection.[41]

The authors conducted two tests. First, subjects were presented with a three-digit number, followed by a second three-digit number a few seconds later, and then asked if the numbers matched.[42] Second, subjects were asked biographical details about themselves (for example, where they were born) followed by an answer (London).[43] In both tests the subjects held a device to indicate their responses.[44] The tests indicated "four principle regions of brain activation [during deception]: prefrontal and frontal, parietal, temporal, and sub-cortical."[45] The authors conclude that their results "provide some initial evidence for the existence and involvement of a prefrontal-parietal-sub-cortical circuit in feigned memory impairment when

34. *Id.*

35. *Id.*

36. *Id.* at 2851.

37. *Id.* at 2852.

38. Tatia M.C. Lee et al., *Lie Detection by Functional Magnetic Resonance Imaging*, 15 HUM. BRAIN MAPPING 157 (2002).

39. *Id.* at 157.

40. *Id.* at 158–59.

41. *Id.* at 159.

42. *Id.*

43. *Id.*

44. *Id.*

45. *Id.* at 161.

tested with a forced-choice format."[46]

3. Langleben et al. (2002)[47]

This experiment tested 18 subjects using playing cards.[48] Subjects were told to select one of three sealed envelopes that contained a card and $20.[49] They were then given additional cards.[50] They were next asked if they had a particular card, and told that they could keep the money if they succeeded in concealing the identity of the card from the sealed envelope from a "computer" that would "analyze their brain activity during the MRI session."[51] Finally, they were told that they would forfeit the money if they lied about any card other than the one from the sealed envelope.[52] The authors found "[i]ncreased activation of the right [anterior cingulate cortex] but not the [dorsolateral prefrontal cortex] during the Lie response," and "no regions more active during Truth than Lie, suggesting that Truth is the baseline cognitive state."[53] The authors thus conclude that "[t]his finding indicates that there is a neurophysiological difference between deception and truth at the brain activation level that can be detected with fMRI."[54]

4. Ganis et al. (2003)[55]

This study investigated two types of deception: memorized lies that fit into a coherent story, on one hand, and spontaneous, isolated lies, on the other.[56] Ten subjects were asked about a memorable work experience or vacation.[57] The subjects were then asked to generate (with assistance) an alternative, false scenario that was coherent and internally consistent.[58] The subjects were then asked questions and told to give three kinds of answers: (1) false answers based on the alternative scenario previously memorized; (2) spontaneous lies without regard to whether the answers were consistent

46. *Id.* at 163.

47. D.D. Langleben et al., *Brain Activity during Simulated Deception: An Event-Related Functional Magnetic Resonance Study*, 15 NEUROIMAGE 727 (2002).

48. For the details of the experiment, see *id.* at 729.

49. *Id.*

50. *Id.*

51. *Id.* at 729.

52. *Id.*

53. *Id.* at 730–31.

54. *Id.* at 731.

55. G. Ganis et al., *Neural Correlates of Different Types of Deception: An fMRI Investigation*, 13 CEREBRAL CORTEX 830 (2003).

56. *Id.* The authors speculate that the differences may matter because: "Spontaneous lies that are isolated are easier to generate than coherent lies because one does not have to cross-check details to ensure that they fit into a larger scheme. . . . [W]orking memory's being more engaged when one generates a coherent lie than an isolated lie because more information has to be held in mind and evaluated. . . . [F]or memorized lies, those that fit into a coherent scenario may be easier to generate because it is easier to recall a lie when more retrieval cues are present." *Id.* at 831 (citations omitted).

57. For the details of the experiment, see *id.* at 831–32.

58. *Id.*

or formed a coherent story; and (3) truthful ones.[59] The authors found that during the spontaneous lies, "a number of brain regions were activated more strongly than when they produced [memorized] lies: the anterior cingulate, extending into the left premotor cortex . . . the left precentral gyrus . . . the right precentral/postcentral gyrus . . . and the right cuneus."[60] With regard to the memorized lies, "only the right anterior middle frontal gyrus . . . was activated more strongly."[61] The authors thus conclude that "[t]hese findings support the idea that lying and telling the truth rely on systematically different neural processes," and "that 'lying' is not a single process or function, but instead is a heterogeneous category."[62]

B. Prior Knowledge

A technique known as "brain fingerprinting" uses an EEG test[63] to measure whether a subject has prior knowledge of the details of an event.[64] The technique purports to establish whether suspects have information "stored" in their brains based on the electrical signals their brains give off when the suspects are shown various words, phrases, or images.[65] The test works by showing a subject three types of stimuli regarding an event: details the suspect has been told or is known to know ("targets"); details that are false or unrelated to the event ("irrelevants"); and details known only by someone at the event ("probes").[66] According to the authors, if the suspect has prior knowledge of details, a certain charge will be emitted by the brain automatically as it is processing the information.[67] In this particular test (which involved six subjects) the authors report an accuracy rate of 100 percent, with no false negatives, false positives, or indeterminate cases.[68]

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59. *Id.* at 832.

60. *Id.* at 833.

61. *Id.*

62. *Id.*

63. Electroencephalography records electrical signals from the brain to electrodes attached to a subject's scalp.

64. Lawrence A. Farwell & Sharon S. Smith, *Using Brain MERMER Testing to Detect Knowledge Despite Efforts to Conceal*, 46 J. FORENSIC SCIS. 135, 135–37 (2001), available at http://www.brainwavescience.com/JourForensicScience.php. A scientist named Lawrence Farwell is the leading developer and proponent of this technique. *See generally* Brain Fingerprinting Laboratories, http://www.brainwavescience.com (last visited Dec. 22, 2006). For a general discussion, see Sara Solovitch, *Mind Reader*, LEGAL AFFAIRS, Nov.-Dec. 2004, at 66. *See also* O'Hara, *supra* note 5, at 1680, 1683 n.8; Denno, *supra* note 6, at 331–35; Andre A. Moenssens, *Brain Fingerprinting—Can It Be Used to Detect the Innocence of a Person Charged with a Crime?*, 70 UMKC L. Rev. 891 (2002).

65. Farwell & Smith, *supra* note 64, at 135–37.

66. *Id.* at 138.

67. *Id.* at 139–40. The authors refer to the charge under the acronym MERMER:

> MERMERs (memory and encoding related multifaceted electroencephalographic responses), of which the P300 is a sub-component, were used to determine whether the subject had the relevant information stored in his brain (information present) or not (information absent), thus indicating whether or not each subject had participated in the real-life event in question.

Id. at 135.

68. *Id.* at 140–41. The authors report similar results in four previous tests. *Id.* at 136.

But, while the science underlying the technique is generally well established, the technique's accuracy has not been independently corroborated: "[T]he amount of peer-reviewed material available to study the efficacy of this method is almost nonexistent . . . ."[69] This has been due, in part, to the refusal of the technique's developer to disclose important details regarding how the test works, including, most significantly, the algorithm used to measure the EEG results.[70]

III. Understanding and Evaluating the Neuroscience Evidence

Any new type of evidence based on technological advancement creates problems for the law. Questions immediately arise regarding its nature, what may or may not be inferred from it, the strength of such inferences, its limitations, and the possible dangers and confusions it could engender. Consider, for example, the invention and widespread use of photography.[71] Photographs were thought by some to be evidence of previously unknown reliability—drawn with "the pencil of God"[72] or a "mirror with a memory."[73] Others, however, noticed the possibility for manipulation and abuse with regard to this evidence, and hence deplored its use in court.[74] Photography, it was thought, potentially could usurp the power of courts to determine facts[75] by shifting power to photography experts, and away from courts, to determine the true nature of reality.[76] None of this happened, of course, because the evidence was eventually assimilated within legal practices. So long as a lay witness can authenticate a photograph (or a video or audio recording) as an accurate representation, the powerful yet fallible evidence may be properly evaluated by legal fact finders.[77] This is now commonplace in evidence law.

The proposed neuroscience evidence shares some striking similarities with the story of photographic evidence. Neuroscience purports to offer powerful, as-yet-unforeseen evidence—probing a suspect's brain directly for evidence of a crime.[78] Therefore, "the invention by neuroscientists of perfectly or extremely reliable lie-detecting or truth-

69. Keckler, *supra* note 11, at 521.

70. *Id.*

71. *See* Jennifer L. Mnookin, *The Image of Truth: Photographic Evidence and the Power of Analogy*, 10 YALE J.L. & HUMAN. 1 (1998).

72. *Id.* at 38.

73. *Id.* at 16 (as described by Oliver Wendell Holmes).

74. *Id.* at 20–27. Mnookin quotes one source who refers to photographs as a "most dangerous perjurer." *Id.* at 26.

75. Or possibly it would purport to undermine the legitimacy of judicial verdicts to the extent they contradicted photographic evidence. This would perhaps have occurred in much the same way DNA evidence is now used as a benchmark for determining whether previous convictions were wrong.

76. *Id.* at 54.

77. *See* FED. R. EVID. 901.

78. *See, e.g.*, Farwell & Smith, *supra* note 64, at 135 ("Physical evidence may or may not be present, but the brain of the criminal is always there, recording the events . . . ."); Ganis et al., *supra* note 55, at 830 ("[W]e examine directly the organ that produces lies . . . .").

compelling methods might have substantial effects on almost every trial and on the entire judicial system."[79] One possible effect might be that neuroscience experts would usurp the jury's power to determine credibility and guilt, a concern Justice Thomas relied on in a recent case in which the Court upheld a categorical ban on polygraph results: "By its very nature, polygraph evidence may diminish the jury's role in making credibility determinations."[80]

If properly understood, however, the neuroscience evidence, like photographic evidence and reliable DNA evidence, may be properly assimilated into legal practices without undermining those practices or usurping powers of judges and juries. Clarifying the nature of the evidence will reveal some important limitations on the inferences that neuroscience evidence can and cannot support. The tests, for example, will not facilitate direct access to a subject's lies or knowledge.[81] Rather, they will provide inductive evidence of a subject's behavior (for example, lying) based on an established correlation between brain states and certain behavior. For reasons explained below, juries and judges will therefore still need to play their traditional roles in evaluating the value of this evidence in light of other evidence in the case. After clarifying the nature of the evidence and how it would fit with traditional fact-finding functions at trial, I discuss the admissibility of the evidence and some hurdles the current research will need to overcome.[82]

The fMRI research discussed above found increased brain activity in certain areas during "deceptive" responses, and no increases during "truthful" activity. To account for the differences, the researchers posit that deception requires more cognitive effort than truthful responses. To lie, a subject

> must construct a new item of information (the lie) while also withholding a factual item (the truth), assuming that he knows and understands what constitutes the 'correct' information. Within such a theoretical framework it is apparent that the truthful response comprises a form of baseline.[83]

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79. Greely, *supra* note 4, at 137.

80. United States v. Scheffer, 523 U.S. 303, 313 (1998). Justice Thomas wrote the opinion for the Court in upholding the rule, but the section discussing the above concern was joined only by three other Justices. *Id.* at 305.

81. And even if they could, this would still not relieve juries of their fact-finding function. The existence of lies or prior knowledge would not necessarily establish guilt in many types of cases. People may lie for other reasons (for example, to protect a third party) or have prior knowledge of a crime scene without being a culprit (for example, when an innocent suspect denies knowledge of a victim's apartment not because he committed the crime but because they were having an affair).

82. As explained earlier, my primary focus is on theoretical issues other than admissibility, namely, those that will arise either after the evidence becomes admissible or regardless of admissibility in the case of criminal-procedure protections. For a detailed analysis of the admissibility of such evidence, see Keckler, *supra* note 11.

83. Spence et al., *A Cognitive Neurobiological Account of Deception: Evidence from Functional Neuroimaging*, *supra* note 27, at 1757. They predict that a truthful response will thus "be made by an honest subject answering the same question or by the liar were he to become distracted or fatigued (in-

Interestingly, part of this posited extra mental work requires what the researchers refer to as "theory of mind."[84] That is, subjects must form beliefs and draw inferences about the mental states—thoughts and ongoing beliefs—of those they are attempting to lie to or deceive.[85] How much extra mental work is required will depend on the nature of the lie because "'lying' is not a single process or function, but instead is a heterogeneous category."[86] For example, spontaneous isolated lies may require different cognitive processes than memorized lies forming a coherent scenario.[87] Finally, this extra cognitive work that is detected by the fMRI test is in some sense involuntary.[88] Because subjects have no control over this activity, researchers posit that it makes the test superior to traditional lie detectors such as polygraphs, which rely on measures of anxiety that a subject may learn to control.[89]

Similar to the fMRI test, the "brain fingerprinting" technique also relies on a measure of involuntary cognitive activity.[90] Rather than relying on increased activity consistent with deception, however, it purports to measure whether information or details are "encoded" or "stored" or "housed" in the subject's brain.[91] According to this conception, the brain of

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deed, from this perspective it is understandable why inebriation or sedation might 'release' the truth via disinhibition: *in vino veritas*)." *Id.* On the last point, however, empirical research confirms that alcohol intoxication decreases suggestibility during interrogation. *See* GUDJONSSON, *supra* note 2, at 426–28.

84. Spence et al., *A Cognitive Neurobiological Account of Deception: Evidence from Functional Neuroimaging*, *supra* note 27, at 1757; Lee et al., *supra* note 38, at 163.

85. Spence et al., *A Cognitive Neurobiological Account of Deception: Evidence from Functional Neuroimaging*, *supra* note 27, at 1757 ("Deceiving another human subject is likely to involve multiple cognitive processes, including theory of mind concerning the victim's thoughts (their ongoing beliefs) . . . ."); Lee et al., *supra* note 38, at 163 ("[A]n essence of lying is the recognition of, and attempt to manipulate, the mental states of others.").

86. Ganis et al., *supra* note 55, at 833. "[T]he generation of various types of lies engages different combinations of general-purpose cognitive processes which, as an ensemble, may provide reliable neural signatures for various types of lies." *Id.*

87. See *id.* at 833 for details.

88. *See* Lee et al., *supra* note 38, at 163 ("[I]t is also clearly evident that controlling one's cerebral activity to avoid detection is unfeasible.").

89. In a typical polygraph test,

> The examiner interprets various physiological responses of the examinee, including blood pressure, perspiration, and respiration, while asking a series of questions, commonly in three categories: direct accusatory questions concerning the matter under investigation, irrelevant or neutral questions, and more general "control" questions concerning wrongdoing by the subject in general. The examiner forms an opinion of the subject's truthfulness by comparing the physiological reactions to each set of questions.

United States v. Scheffer, 523 U.S. 303, 313 n.9 (1998) (citations omitted) (concluding that a rule categorically excluding polygraph evidence did not violate a constitutional right to present a defense because of the technique's questionable reliability). *See also* Wolpe et al., *supra* note 10, at 40 ("The physiological data measured in polygraphy signify the activity of the autonomic nervous system, and so may reflect not only arousal during deception but anxiety in general, no matter the cause.").

90. Farwell & Smith, *supra* note 64, at 135 ("[T]he evidence reported here, and in several other studies, suggests that recent advances in neuroscience allow scientists to detect information stored in the brain—information that potentially could scientifically, objectively, non-invasively, and accurately connect a criminal with a specific criminal act.").

91. *Id.* *See also* Moenssens, *supra* note 64, at 903 ("Brain fingerprinting, at its best, can only detect

a subject records and encodes the details of a perceived event while it is taking place, and when later presented with details about the event, the brain's response during the test "reveals" whether the information is present. Consider this metaphor provided by Farwell and Smith:

> Investigators' need for other accurate, scientific means of linking perpetrators with crime scene evidence has inspired some scientists to ask, "What does the criminal always take with him from the crime scene that records his involvement in the crime?" The answer to this question, of course, is the brain. Physical evidence may or may not be present, but the brain of the criminal is always there, recording the events, in some ways like a video camera.[92]

The above conceptions, however, may misleadingly suggest that the tests will support a direct, deductive inference that a lie has taken place or that a subject has prior knowledge.[93] On the contrary, the presence of a particular brain state of a subject will not necessarily mean that the person has lied, nor will an electrical discharge mean we can see what is recorded on the subject's mental "video camera." The evidence may be better understood by reflecting on the relevant concepts involved and their articulations because the empirical research presupposes these concepts and their sense.[94] In particular, based on the conceptions provided by the researchers, the neuroscience evidence presupposes several psychological concepts and related capacities—not just to "lie," "deceive," and "know," but also to "think," "believe," "perceive," "recognize," "infer," and so on.[95] Addition-

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whether certain knowledge exists in the subject's brain."); Denno, *supra* note 6, at 333 ("Brain fingerprinting is based upon the principle that the human brain houses information . . . .").

92. Farwell & Smith, *supra* note 64, at 135.

93. *See* Wolpe, *supra* note 10, at 39–40 ("For the first time, we would need to define . . . the limits of the state's right to peer into an individual's thought processes . . . ."). This is misleading. The tests do not "peer" into thought processes; they "peer" at brain states, which may or may not be correlated with deceptive behavior or prior knowledge.

94. *See* M.R. BENNETT & P.M.S. HACKER, PHILOSOPHICAL FOUNDATIONS OF NEUROSCIENCE 402–07 (2003). The authors explain:

> Neuroscientific research . . . abuts on the psychological, and clarity regarding the achievements of brain research presupposes clarity regarding the categories of ordinary psychological description—that is, the categories of sensation and perception, cognition and recollection, cogitation and imagination, emotion and volition.

Id. at 115. *See also* Dennis M. Patterson, *Philosophical Foundations of Neuroscience*, NOTRE DAME PHIL. REVS., Sept. 10, 2003, http://ndpr.nd.edu/review.cfm?id=1335 (reviewing M.R. BENNETT & P.M.S. HACKER, PHILOSOPHICAL FOUNDATIONS OF NEUROSCIENCE (2003)); P.F. STRAWSON, ANALYSIS AND METAPHYSICS: AN INTRODUCTION TO PHILOSOPHY 17–28 (1992).

95. Two analogies may help to illustrate how a focus on the concepts involved may improve understanding of the nature of the evidence. A bounty hunter searching for a fugitive is targeting the fugitive, not his picture on the "wanted" poster, but the failure to attend to the details of the poster will make it less likely the hunter will find his target. *See* FRANK JACKSON, FROM METAPHYSICS TO ETHICS: A DEFENCE OF CONCEPTUAL ANALYSIS 30 (1998). Similarly, eyeglass wearers know that even though they care more about the world they see through the glasses than the glass itself, they should care about flaws in the glass nonetheless. To dismiss flaws in the glass because they care about the world would be absurd. *See* BENNETT & HACKER, *supra* note 94, at 401. Likewise, it would be absurd to dismiss the focus on our psychological concepts, and the language we use to express them, because we are interested in the capacities themselves. *See also* Timothy Williamson, *Past the Linguistic Turn?*, *in* THE FUTURE FOR PHILOSOPHY 106, 125–26 (Brian Leiter ed., 2004).

ally, the fMRI situation presupposes not only such concepts and capacities on the part of subjects, but also presupposes that subjects themselves ascribe such states to their listeners.

These presuppositions are significant for two reasons. First and less importantly, they make unlikely the success of an "eliminative materialist" proposal in this particular context; such a proposal would seek to eliminate discussion of such mental concepts and predicates and instead focus solely on the supposed correlated brain states.[96] In this context, such a project likely could not get off the ground because the presupposed concepts are necessary to make sense of and explain human actions.[97] The second and more important reason is that the above considerations show that the concepts and capacities presupposed cannot simply be identified with the brain states. The brain state is not identical with the lie or the knowledge. Unlike neuroscience evidence, which provides inductive evidence of lying or knowing, other evidence provides criterial (conceptually or logically good) evidence of such conduct.[98] To illustrate, two examples of actions that can serve as criterial evidence are the assertion of a known false statement, or the manifestation of knowledge of a fact by asserting the fact and what justifies believing it. In the case of conflict between these two kinds of evidence—a sincere assertion with an fMRI indication of "lie," or a sincere denial of knowledge of a crime scene with a "brain fingerprinting" result of "knowledge"—the criterial evidence trumps the neuroscience evidence.[99] The problem would be with the neuroscience evidence; its presupposition of uniformity of brain states among individuals would be

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96. *See, e.g.*, Paul M. Churchland, *Eliminative Materialism and the Propositional Attitudes*, 78 J. PHIL. 67, 67 (1981). For a general discussion of this position, see William Ramsey, *Eliminative Materialism*, STAN. ENCYCLOPEDIA PHIL., May 8, 2003, http://plato.stanford.edu/entries/materialism-eliminative/ (Eliminative materialism is "the radical claim that our ordinary, common-sense understanding of the mind is deeply wrong and that some or all of the mental states posited by common-sense do not actually exist."). Such a proposal, for example, might try to define crimes such as perjury simply as having the relevant brain state, not as engaging in specific conduct. This is not to deny that eliminative programs might be more likely in other, non-legal contexts.

97. Donald Davidson has made this general point in several essays. To interpret human behavior as *intentional* and as an *action* requires a description of it employing these presupposed mental concepts. *See, e.g.*, DONALD DAVIDSON, *Three Varieties of Knowledge*, *in* SUBJECTIVE, INTERSUBJECTIVE, OBJECTIVE 205, 217 (2001) ("[I]t is part of the concept of an intentional action that it is caused and explained by beliefs and desires; it is part of the concept of a belief or a desire that it tends to cause, and so explain, actions of certain sorts."). In addition, the law explains action in terms of mental states. *See* Stephen J. Morse, *New Neuroscience, Old Problems*, *in* NEUROSCIENCE AND THE LAW: BRAIN, MIND, AND THE SCALES OF JUSTICE, *supra* note 4, at 157, 158–64.

98. BENNETT & HACKER, *supra* note 94, at 83 ("[I]f a person avows that he is not in pain, yet evidence from PET or fMRI suggests that he is, the latter is defeated by the agent's sincere utterance, and the inductive correlations of the data . . . need to be re-examined."). As the authors explain, "[t]he brain does not satisfy the criteria for being a possible subject of psychological predicates." *Id.*

99. This does not suggest that a psychological concept will necessarily be *reducible* to criterial evidence; one can conceal pain or manifest pain behavior when not in pain. Criterial evidence can be overridden in certain circumstances. The main point here is that in the relevant case, we want to determine whether the assertion is sincere or not, but the neuroscience evidence cannot provide a *necessarily* true answer one way or the other.

wrong.[100] The best that the neuroscience evidence can accomplish is to make more reliable predictions. But the possibility will remain for contrary criterial, logically good evidence to override the neuroscience evidence.[101]

The distinction between criterial and inductive evidence for proving mental states helps to clarify some confusion in the descriptions of the above-described neuroscience evidence. It is somewhat of a series of misleading metaphors to suggest that the brain stores or houses knowledge,[102] that knowledge or lies "exist" in the brain, and that the brain is like a video camera.[103] To "know" (facts or how to perform a task) is an achievement verb (or success word).[104] To illustrate this, suppose both A and B witnessed C commit a bank robbery. At a subsequent lineup, A successfully picks out C and states, "that is the guy I saw commit the robbery," while B states sincerely in the same lineup that he cannot identify anyone as the robber. A knows C did it;[105] B may not[106]—regardless of what any brain scan shows. This is not to deny, of course, that a brain and its parts aren't *necessary* for such conduct; rather they aren't *sufficient* for attributing knowledge in the example.[107] Moreover, to ascribe such predicates to the

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100. For an additional argument that brain states are not *sufficient* to establish lies, see Tom Buller, *Can we Scan for Truth in a Society of Liars?*, AM. J. BIOETHICS, Mar.-Apr. 2005, at 58, 58–60.

101. Or, more likely, evidence of criterial evidence will override the neuroscience evidence. This latter evidence will likely focus on whether there is any additional evidence to believe or disbelieve the subject. This will include all the typical ways we infer such conduct generally. *See supra* note 2. Moreover, both the reliability of the neuroscience evidence and the strength of possible criterial evidence (or whether it should be overridden) will involve a "reference class" issue. *See* Michael S. Pardo, *The Field of Evidence and the Field of Knowledge*, 24 LAW & PHIL. 321, 374–83 (2005). In particular, the issue is why or why not this subject, on this occasion, should be seen as a typical member of the sets underlying the generalizations regarding both kinds of evidence. *Id.*

102. *See* Moenssens, *supra* note 64, at 891, 898; Denno, *supra* note 6, at 333–34; Farwell & Smith, *supra* note 64.

103. Farwell & Smith, *supra* note 64, at 135. For a critique of the notion that the brain "stores," "houses," "encodes," or "records" knowledge, see BENNETT & HACKER, *supra* note 94, at 151–71.

104. *See* BENNETT & HACKER, *supra* note 94, at 257. Of course, passive *reception* of knowledge may occur at a crime scene, which a defendant may later recognize when confronted with details. In such a case, however, recognition is manifested in behavior. For a discussion of "achievement" and "success" words generally, see Dennis Patterson, *Fashionable Nonsense*, 81 TEX. L. REV. 841, 885–92 (2003) (reviewing ANTHONY G. AMSTERDAM & JEROME BRUNER, MINDING THE LAW (2000); STEVEN L. WINTER, A CLEARING IN THE FOREST: LAW, LIFE, AND MIND (2001); VINCENT DESCOMBES, THE MIND'S PROVISIONS: A CRITIQUE OF COGNITIVISM (Stephen Adam Schwartz trans., Princeton Univ. Press 2001) (1994); ALVIN I. GOLDMAN, KNOWLEDGE IN A SOCIAL WORLD 60 (1999) ("[T]hese terms imply that some sort of goal, undertaking, or function has been accomplished.")).

105. I am assuming that the testing procedures were not problematic such that A would have picked C even if A did not really see C do it. If this were the case, A would not know. In other words, I assume that A did not pick C by accident. For more on this issue and its relation to the concept of knowledge, see Pardo, *The Field of Evidence and the Field of Knowledge*, *supra* note 101, at 322–23, 331–33.

106. B may know but not be able to recall at that time. B's tacit knowledge would, therefore, be like having an ability B didn't know she had. Knowing does not entail knowing one knows. *See* Pardo, *The Field of Evidence and the Field of Knowledge*, *supra* note 101, at 341–42. The knowledge would later be manifested when remembered. *Id.*

107. *See* WILFRID SELLARS ET AL., EMPIRICISM AND THE PHILOSOPHY OF MIND 76 (1956) ("The essential point is that in characterizing an episode or a state as that of *knowing*, we are not giving an empirical description of that episode or state; we are placing it in the logical space of reasons . . . ."). This same point applies to other epistemic concepts as well, such as evidence, justification, doubt, certainty,

brain, as in the "brain lies" or "the brain knows," commits what Bennett and Hacker refer to as a "mereological" fallacy, that is, to ascribe to a part what only makes sense to ascribe to the whole.[108]

These conceptual clarifications help to further show why the proposed neuroscience evidence would not usurp or diminish court functions. Consider in more detail Justice Thomas's critique of lie-detection technology on these grounds. A legitimate governmental interest, he explained, is preserving the "core function" of "making credibility determinations in criminal trials"; a "fundamental premise" of that function is "that 'the *jury* is the lie detector.'"[109] The lie-detection technician, rather than the jury, would be the primary judge of credibility, with the jury deferring to the technician's opinion:

> Unlike other expert witnesses who testify about factual matters outside the jurors' knowledge, such as the analysis of fingerprints, ballistics, or DNA found at a crime scene, a [lie-detection] expert can supply the jury only with another opinion, in addition to its own, about whether the witness was telling the truth.[110]

Consequently, jurors may blindly defer to the technician and "abandon their duty to assess credibility and guilt."[111]

But, Justice Thomas's distinction notwithstanding, the problem of deference to expert opinion is a problem for all expert testimony.[112] There is no reason to believe that jurors will be less able to assess neuroscience evidence than they are to assess DNA evidence or any other scientific evidence.[113] Highly reliable DNA results may be just as likely to cause defer-

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probability, reliability, and so forth. Brain states cannot provide the *connections* between these concepts, either—for example, they cannot provide the relationships between knowledge and justification, evidence and knowledge, or evidence and probability. *See* TIMOTHY WILLIAMSON, KNOWLEDGE AND ITS LIMITS 184–237 (2000). Conceptual issues relating to knowledge and these other epistemic concepts are also important for evidence law. For a general account, see Pardo, *The Field of Evidence and the Field of Knowledge*, *supra* note 101, at 321–92.

108. BENNETT & HACKER, *supra* note 94, at 29. Mereology is the branch of logic that concerns the relationship between parts and wholes. This critique may apply to attempts to explain other mental concepts—for example, intent or voluntariness—in terms of brain states. *See, e.g.*, Denno, *supra* note 6, at 275–76 (stating that voluntariness requires an "internal event[] or volition"); O'Hara, *supra* note 5, at 1681–82. Such reductive attempts eliminate the normative, social aspects of the human actions. *See* Patterson, *Philosophical Foundations of Neroscience*, *supra* note 94; Patterson, *Fashionable Nonsense*, *supra* note 104.

109. United States v. Scheffer, 523 U.S. 303, 312–13 (1998) (emphasis added) (quoting United States v. Barnard, 490 U.S. 907, 912 (9th Cir. 1973)).

110. *Id.* at 313.

111. *Id.* at 314.

112. *See* Ronald J. Allen & Joseph S. Miller, *The Common Law Theory of Experts: Deference or Education?*, 87 NW. U. L. REV. 1131, 1133 (1993).

113. Recent studies contend that jurors may "undervalue" DNA "random match" evidence. Dale A. Nance & Scott B. Morris, *Juror Understanding of DNA Evidence: An Empirical Assessment of Presentation Formats for Trace Evidence with a Relatively Small Random-Match Probability*, 34 J. LEGAL STUD. 395, 401 (2005); Dale A. Nance & Scott B. Morris, *An Empirical Assessment of Presentation Formats for Trace Evidence with a Relatively Large and Quantifiable Random Match Probability*, 42 JURIMETRICS J. 403, 404 (2002). These studies, however, rely on problematic assumptions regarding the probative value of evidence. *See* Ronald J. Allen & Michael S. Pardo, *The Problematic Value of Mathematical Models of Evidence*, 36 J. LEGAL STUD. (forthcoming Jan. 2007). Regardless, however,

ence, yet jurors are trusted to not abandon their duties to determine credibility and guilt. Nor does the fact that the neuroscience evidence would be tied more directly to the credibility of witness statements render the evidence problematic. Despite some initial resistance, courts have become more receptive to other kinds of expert testimony that may help jurors assess witness statements. Testimony regarding eyewitness identifications[114] and false confessions[115] are two prominent examples. Like these areas, the neuroscience evidence, when properly explained, may assist rather than hinder jurors in assessing statements—and such assistance is the whole point of expert testimony.[116] In these three areas (lie detection, false confessions, and eyewitness identifications), the expert evidence may be highly probative precisely because it provides jurors with more information from which to draw inferences about particular statements beyond their commonsense background understanding. Empirical evidence strongly suggests that jurors are not blindly deferential to other reliable scientific expert testimony, and there is no good reason to think that this evidence would be qualitatively different.

Because even a highly reliable neuroscience test would not establish knowledge or lies directly, jurors would still need to play their traditional role in assessing it. In making these assessments, the jury would, for example, consider whether other evidence regarding credibility should override the test results, rendering the test conclusion unlikely. Consider the possibility of errors in conducting or analyzing the test, with known error rates told to the jury, and consider the possibility of perjury by the technician. These considerations, as well as other evidence in the case, would all affect the probative value of the evidence[117]—and nothing in the nature of the neuroscience evidence, or in its complexity, would prevent jurors from adequately assessing its probative value in a particular case in light of the above considerations.

Beyond these conceptual issues, the neuroscience evidence in its

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the studies still support the proposition that jurors are not uncritically deferential to such evidence.

114. In a recent case upholding the admission of such testimony, for example, Judge Easterbrook explained: "[I]t may be prudent to avoid complicating criminal trials with general scientific evidence about the psychology of identification—though scientific evidence that a given person deviates from the norm (for example, is exceptionally suggestible) may be invaluable." Newsome v. McCabe, 319 F.3d 301, 306 (7th Cir. 2003).

115. In vacating a conviction because the district court excluded expert testimony regarding false confessions, Judge Diane Wood explained:

> It was precisely because juries are unlikely to know that social scientists and psychologists have identified a personality disorder that will cause individuals to make false confessions that the testimony would have assisted the jury in making its decision. It would have been up to the jury, of course, to decide how much weight to attach to Dr. Ofshe's theory, and to decide whether they believed his explanation of Hall's behavior or the more commonplace explanation that the confession was true.

United States v. Hall, 93 F.3d 1337, 1345 (7th Cir. 1996).

116. *See* FED. R. EVID. 702.

117. *See* Pardo, *The Field of Evidence and the Field of Knowledge*, *supra* note 101; *see also* Allen & Pardo, *supra* note 113.

present state faces some empirical limitations. The fMRI researchers note its nascent stage.[118] The studies have involved small samples, relatively low-stakes and less-emotional situations, and the findings involve generalizations from groups of individuals.[119] The widespread legal admissibility of such a test therefore likely awaits more individualized reliability:

> the studies . . . concern the averaged brain activities of groups of subjects and we are aware of no study to date that has provided convincing evidence of a physiology of deception at the level of the single subject. Hence, there may well be a range of individual differences and it would be premature to extrapolate from the sorts of data we have considered to the individual suspect in the courtroom or the cell.[120]

As the research develops, however, reliable individualized results may emerge.[121] Reliable individualized results would make the tests admissible under federal rules of admissibility, perhaps initially for limited purposes such as impeachment.[122] The evidence would, by hypothesis, be based on sufficient data and reliable principles and methods.[123] More importantly, individualized results would better fit forensic settings and hence would be applied "reliably to the facts of the case."[124] In addition, the evidence would satisfy the additional guiding factors the Supreme Court identified in *Daubert* for assessing the admissibility of scientific evidence: the techniques and underlying principle would be falsifiable, subject to peer review and publication, and have identifiable error rates.[125] Given the wide

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118. *See, e.g.*, Spence et al., *A Cognitive Neurobiological Account of Deception: Evidence from Functional Neuroimaging*, *supra* note 27, at 1760–61.

119. *See* Spence et al., *Behavioural and Functional Anatomical Correlates of Deception in Humans*, *supra* note 31, at 2852; Wolpe et al., *supra* note 10, at 43:

> The baseline brain activity, and thus fMRI signals, of subjects varies with age, health status and multitude of other variables (including the use of prescription or illicit drugs, depression, or the presence of a personality disorder). Clearly the results of these studies cannot be generalized to the "real world" populations of criminal and terrorist suspects.

Similar concerns regarding the disjunction between clinical findings and "real world" situations are expressed regarding polygraphs. *See* NAT'L RESEARCH COUNCIL, *supra* note 13, at 3.

120. Spence et al., *A Cognitive Neurobiological Account of Deception: Evidence from Functional Neuroimaging*, *supra* note 27, at 1761. *See also* Keckler, *supra* note 11, at 542 ("[T]he estimated error rate for any particular pattern activation as indicative of lying, *without calibration on the individual*, would be unacceptably high for admissibility."). At least one of the commercial providers of such tests, however, asserts that its services to litigators will be available in 2006. *See* Cephos Corporation, *supra* note 19.

121. The research is currently attempting to make such individualized assessments. *See* Daniel D. Langleben et al., *Telling Truth from Lie in Individual Subjects with Fast Event-Related fMRI*, 26 HUM. BRAIN MAPPING 262 (2005).

122. Keckler, *supra* note 11, at 537–53, provides a model for admitting such evidence for impeachment purposes in civil cases.

123. The underlying science is not in dispute. *See* FED. R. EVID. 702(1),(2).

124. *See* FED. R. EVID. 702(3).

125. *See* Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 593–94 (1993). The last variable—known error rates—is a serious problem for certain kinds of expert testimony (such as handwriting, voice, bite-mark, ballistics, and even fingerprint identifications) because in some cases they may be quite high but not revealed to courts and juries. *See* Saks & Koehler, *supra* note 21. With regard to the

discretion to trial judges to determine admissibility in this area,[126] there may be an initial divergence in the willingness of courts to admit the evidence, but (perceived) reliable use for limited purposes in some initial cases may lead to an increased willingness of other courts to exercise their discretion and admit it.[127]

The "brain fingerprinting" technique has presented more immediate challenges and difficulties.[128] In two cases, defendants have sought to prove their innocence by showing the test revealed that they did not have knowledge of the details of the crimes for which they were convicted. In one case, the court reversed on other grounds without relying on the evidence;[129] in the second, a state appellate court refused to grant post-conviction relief on the basis of such evidence.[130] This second court based its decision on the failure to provide corroboration of the claims that the technique is reliable, has been extensively tested, has been analyzed in "numerous" peer-reviewed journals, has a low error rate, or is generally accepted in the "relevant scientific community."[131] Like the fMRI evidence, however, this evidence may become admissible under federal standards if it is shown to be based on sufficient data and applied reliably to the facts in

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neuroscience evidence, knowing the error rates may be just as important as the error rates being sufficiently low; the fact-finder needs this information to determine how much probative value to assign to the evidence.

126. In *General Electric Co. v. Joiner*, 522 U.S. 136, 141–43 (1997), the Court concluded that district court decisions regarding the admissibility of expert testimony should be reviewed for abuse of discretion. Subsequently, in *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 147–48, 152–53 (1999), the Court clarified that *Daubert* applies to all expert testimony in federal courts, and that the abuse-of-discretion standard applied to both conclusions about admissibility and decisions about which factors are important for assessing the reliability of such evidence.

127. Therefore, states that still adhere to the pre-FED. R. EVID. 702 standard of "general acceptance" articulated in *Frye v. United States*, 293 F. 1013, 1014 (D.C. Cir. 1923) will take longer to admit such evidence. A similar story will likely be told about the admissibility of "mitochondrial" DNA testing. *See* Edward K. Cheng, *Mitochondrial DNA: Emerging Legal Issues*, 13 J.L. & POL'Y 99, 101–03 (2005).

128. Solovitch, *supra* note 64, discusses a similar study of the technique that found only a 50% accuracy rate. Moreover, it is not clear why previously having observed similar events or people might not be enough to (incorrectly) trigger a "knowledge" result. For example, suppose a subject undergoing the test is shown a picture of a victim who just happens to look like his Aunt Sally, or a scene that shares similarities with his friend's home.

129. Harrington v. State, 659 N.W.2d 509, 516 (Iowa 2003) ("Because the scientific testing evidence is not necessary to a resolution of this appeal, we give it no further consideration."). The court explained the evidence as follows:

> This testing evidence was introduced through the testimony of Dr. Lawrence Farwell, who specializes in cognitive psychophysiology. Dr. Farwell measures certain patterns of brain activity (the P300 wave) to determine whether the person being tested recognizes or does not recognize offered information. This analysis basically "provide[s] information about what the person has stored in his brain." According to Dr. Farwell, his testing of Harrington established that Harrington's brain did not contain information about Schweer's murder. On the other hand, Dr. Farwell testified, testing did confirm that Harrington's brain contained information consistent with his alibi.

Id. at 516 n.6.

130. Slaughter v. State, 105 P.3d 832, 834–36 (Okla. Crim. App. 2005).

131. *Id.* at 835.

the case. The technique already appears to be based on reliable principles and methods;[132] therefore, independent testing[133] and corroboration of Farwell's technique may make admissibility more likely, with greater acceptance perhaps to follow.[134]

I next turn to how the Constitution will respond to the compelled production of such evidence. For the rest of this article, I will assume that whenever admissibility is an issue, both techniques will have evolved to a sufficient level of reliability to warrant admissibility. But even if not admissible, the tests may still be used for investigative purposes, in which case the Constitution will still limit their use.

IV. Constitutional Criminal Procedure

Advances in technology have posed difficult issues for criminal-procedure jurisprudence. On one hand, the advances allow the gathering of information that might otherwise be obtained only through typical violations of constitutional protections. On the other hand, the advances also sometimes remove the factual predicates normally thought necessary for such violations. For example, listening devices placed outside phone booths[135] and thermal-imaging devices aimed at houses[136] reveal information about conversations and the inside of homes, but without the need for the physical trespass once thought necessary for a violation of the Fourth Amendment.[137] Neuroscientific evidence raises similar tensions. On the one hand, the fMRI lie detector and the "brain fingerprinting" technique share similarities with other physical examinations such as blood tests,

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132. Moenssens, *supra* note 64, at 916–20, reaches a similar conclusion.

133. Judge Lumpkin's opinion in *Slaughter*—focusing on the lack of independent corroboration—appears to be an excellent example of a court's ability to take flexible, gate-keeping functions seriously with regard to expert testimony (as *Daubert* and *Kuhmo* suggested they could and should). *Slaughter*, 105 P.3d at 835 ("[B]eyond Dr. Farwell's affidavit, we have no real evidence that Brain Fingerprinting has been extensively tested . . . ."). Despite the powerful results reported by Farwell, see Brain Fingerprinting Laboratories, *supra* note 64, independent testing of the technique would provide a much greater assurance of reliability, rather than relying on the say-so of one expert who is purporting to revolutionize the field of lie detection.

134. Once either type of neuroscience evidence is sufficiently reliable to satisfy admissibility standards, society in general (primarily in the criminal context), and parties in particular, will have to face important practical issues regarding the costs of the evidence compared with the probative value it produces. These debates are beyond the scope of this article. Risinger, *supra* note 14, has addressed such issues and suggests that the "practical impact" that lie-detection evidence may have may be too dramatic to allow even highly reliable lie-detection evidence to be admissible. There is no way to determine *a priori*, however, whether such impact would be for the better or for the worse. DNA evidence, for example, has had a dramatic influence on litigation—for the better. If jurors are indeed poor at assessing credibility based on demeanor, see Olin Guy Wellborn III, *Demeanor*, 76 CORNELL L. REV. 1075, 1078–91 (1991), then such evidence could perhaps improve juror decision-making. If so, then Risinger's insights about the widespread effects of such evidence may point in the other direction; it seems backward (to me at least) to argue against the admissibility of evidence because could it have a positive impact in most cases rather than just a few.

135. Katz v. United States, 389 U.S. 347, 352–53 (1967).

136. Kyllo v. United States, 533 U.S. 27, 34–35 (2001).

137. Silverman v. United States, 365 U.S. 505, 509–13 (1961).

breathalyzer tests, and fingerprint tests, which may be compelled under certain circumstances. On the other hand, the neuroscience tests arguably are qualitatively different in that they compel inductive evidence of mental events, beliefs, thoughts, and propositional knowledge.

How this tension is resolved will depend on how both the evidence and the constitutional protections are conceptualized. The former was the subject of Part III; the latter and how the two fit together is the subject of this Part. Although the neuroscience research is still in a nascent stage, it continues apace.[138] Exactly how the effects of this technology "would play out in light of our current criminal justice system, including the constitutional protections of the Bill of Rights, is not obvious."[139] How the legal system will or should respond to the compelled use of such evidence, given the significant constitutional issues at stake, needs to be answered before its use becomes widespread.[140]

The Fourth Amendment's ban on unreasonable searches or seizures and the Fifth Amendment's ban on compelled self-incrimination work together to regulate government evidence gathering.[141] In addition to these provisions, due process, both procedural and substantive, provides additional constraints on government evidence gathering not otherwise prohibited. The neuroscientific evidence is analyzed below in terms of such provisions. Before turning to that constitutional analysis directly, however, a few words on analytical method are necessary.

My analysis of the neuroscience tests begins with the core, entrenched practices and principles associated with the relevant provisions (the Fourth Amendment, the Self-Incrimination Clause, and the Due Process Clause). An alternative analysis of the neuroscience tests would in contrast search for a single normative justification or principle that underlies the particular provisions and from which doctrinal consequences regarding the tests may be deduced.[142] Theories using the alternative analysis are legion and problematic. They are problematic because they are both over- and under-inclusive in explaining not only current practices and rules, but also in explaining intuitively desirable ones as well. Consider, by way of illustration, three examples of such theories regarding the privilege against self-incrimination.[143] Attempts have been made to justify the privilege in

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138. *See supra* notes 118–20.

139. Greely, *supra* note 4, at 137.

140. Additionally, even if the science never becomes reliable enough to become admissible or used as an investigative tool, the example provides a good hypothetical for testing the limits of various constitutional theories. *See infra* at pp. 48–52.

141. The relationship between the two amendments is explained in Pardo, *Disentangling the Fourth Amendment and the Self-Incrimination Clause*, *supra* note 23.

142. *See, e.g.*, Robert S. Gerstein, *Privacy and Self-Incrimination*, 80 ETHICS 87, 87–88 (1970):

> Any defense of the privilege must be founded on a clearly articulated justification for its existence. It must be a justification which will form a solid basis for the core of the privilege as we now know it, while offering criteria for a soundly rationalized redrawing of the boundaries for its applicability.

143. For analysis of additional theories, see Pardo, *Disentangling the Fourth Amendment and the Self-*

terms of the following rationales: it protects privacy;[144] it prevents torture and other abusive tactics;[145] and it protects dignity[146] by not subjecting people to the "cruel trilemma" of incrimination, perjury, or contempt.[147]

Although each of these rationales sheds some light on the possible justifications underlying the privilege, and consequently on how the privilege may be implicated by the neuroscience tests, none of these rationales by itself can explain the privilege's presence or absence in core, intuitively clear examples. Privacy rationales cannot explain the privilege's absence when those granted immunity are forced to disclose private information about themselves, or why anyone can be forced to disclose private, incriminating information about friends and family members. On the flipside, a privacy rationale cannot explain the privilege's applicability when the government already knows the information. Likewise, *contra* a torture rationale, the privilege applies in non-torturous situations, like in open court, and the privilege does nothing to prevent abusive practices when incriminating information is not used in a criminal prosecution.[148] Finally, the "cruel trilemma" rationale cannot explain the privilege's absence when one faces a similar trilemma upon being compelled to provide a voice, handwriting, or urine sample.[149] Proponents of such theories may claim that the practices and rules should therefore be revised, but such required revisions may more plausibly provide *reductio ad absurdum* conditions for the theories.[150]

The failure of such theories has caused some to criticize the provisions as being unjustified or irrational.[151] Such criticism is misplaced for two reasons. First, the criticism assumes that each provision must have a single justification that provides necessary and sufficient conditions for the provision's application. But such conditions are themselves unnecessary. A rule may prevent various kinds of situations from occurring, each of which may share similarities with others in the group, without all of the situations being reducible to one characteristic. The privilege against self-

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Incrimination Clause, *supra* note 23, at 1862–66. Similar arguments could be made regarding normative theories of the Fourth Amendment. *See* Ronald J. Allen & Ross M. Rosenberg, *The Fourth Amendment and the Limits of Theory: Local Versus General Theoretical Knowledge*, 72 ST. JOHN'S L. REV. 1149 (1998).

144. *See, e.g.*, Peter Arenella, *Schmerber and the Privilege Against Self-Incrimination: A Reappraisal*, 20 AM. CRIM. L. REV. 31 (1982).

145. *See* Murphy v. Waterfront Comm'n, 378 U.S. 52, 55 (1964).

146. For a discussion of general dignity-based defenses, see Gerstein, *supra* note 142, at 88–94; R. Kent Greenawalt, *Silence as a Moral and Constitutional Right*, 23 WM. & MARY L. REV. 15, 39 (1981).

147. *Murphy*, 378 U.S. at 55.

148. *See* Chavez v. Martinez, 538 U.S. 760, 770–73 (2003).

149. On the last example, see the fictional account at a tennis academy in DAVID FOSTER WALLACE, INFINITE JEST 151–56 (1996).

150. For further meta-theoretic discussions of these theories see Pardo, *Disentangling the Fourth Amendment and the Self-Incrimination Clause*, *supra* note 23, at 1862–66.

151. *See* David Dolinko, *Is There a Rationale for the Privilege against Self-Incrimination?*, 33 UCLA L. REV. 1063 (1986); Henry J. Friendly, *The Fifth Amendment Tomorrow: The Case for Constitutional Change*, 37 U. CIN. L. REV. 671 (1968).

incrimination appears to apply to such a "family resemblance"[152] of events—preventing some kinds of abusive conduct, eliminating some kinds of unreliable evidence, and protecting some kinds of privacy. Second, criticisms of the privilege for not having one essential normative justification collapse the difference between a rule and its justification(s).[153] Part of what constitutes a rule's existence is that it may operate independently of its justification(s). For example, the justification for a restaurant's rule not to allow pets inside may be to avoid noisy disruptions, but the rule would still apply to quiet pets and not apply to noisy children.[154] Indeed, where a rule has several justifications—such as a "no pets" rule to prevent noise, messes, health-code violations, disturbance of allergic customers, and so on—the overarching rule eases administration and avoids deciding each problem on a case-by-case basis with regard to several different justifications.[155] A similar situation plausibly applies to the privilege against self-incrimination. In any event, in the below analysis, rather than look for one deep justification for the constitutional provisions by which to analyze the neuroscientific evidence, I analyze the evidence in light of the provisions' entrenched rules and practices.

While accepting the entrenched practices for each provision, the analysis does not settle for indiscriminate description of every decision in the area.[156] Rather, the entrenched practices may be used to critique gaps or inconsistencies in other parts of the legal doctrine.[157] The next subsections apply a two-part framework, which I have previously developed for evaluating situations that implicate both the Fourth and Fifth Amendments.[158]

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152. The notion of a "family resemblance" concept is Wittgenstein's, who argued against the mistake that our uses of a concept must share an essential characteristic. Rather—like members of a family who share some physical characteristics with others, who in turn share different characteristics with others, and so on—some concepts have multifarious uses, which share different similarities with others. His famous example involved "games." LUDWIG WITTGENSTEIN, PHILOSOPHICAL INVESTIGATIONS 31–34 (G.E.M. Anscombe trans., 1953). Frederick Schauer has suggested that the "family resemblance" idea may apply to the justifications and practices covered by "free of speech." *See* FREDERICK SCHAUER, FREE SPEECH: A PHILOSOPHICAL ENQUIRY 14 (1982).

153. *See* FREDERICK SCHAUER, PLAYING BY THE RULES: A PHILOSOPHICAL EXAMINATION OF RULE-BASED DECISION-MAKING IN LAW AND IN LIFE 53–76 (2002).

154. *See id.* at 63.

155. In Schauer's terminology this would constitute a "rule-generating justification," namely, a reason to formulate a rule rather than always appealing to the various underlying justifications whenever each new situation arises. *See id.* at 94.

156. For examples of such descriptive/predictive theories, see Allen & Rosenberg, *supra* note 143; Allen & Mace, *supra* note 17, at 248–49.

157. The process resembles the reflective relationship between theory and particular cases discussed in NELSON GOODMAN, FACT, FICTION, AND FORECAST 64 (4th ed. 1983) and JOHN RAWLS, A THEORY OF JUSTICE 42–45 (rev. ed. 1999). Pardo, *Disentangling the Fourth Amendment and the Self-Incrimination Clause*, *supra* note 23, at 1881–1902, for example, demonstrates how, based on entrenched practices, courts have transposed doctrinal considerations relevant to the Fourth and Fifth Amendments, respectively, in areas involving subpoenas, stop-and-identify statutes, and the use of pre-arrest silence as evidence of guilt.

158. *See* Pardo, *Disentangling the Fourth Amendment and the Self-Incrimination Clause*, *supra* note 23, at 1879–81. According to this view, government evidence-gathering faces a general first-level reasonableness inquiry (Fourth Amendment); then, at a more specific second level, the self-incrimination

The first step is to ask, does the Fourth Amendment render the attempt at evidence-gathering unreasonable? The second step is to ask, even if reasonable, does the attempt seek to compel incriminating propositional content from a suspect's mind in order use it against that suspect in a criminal prosecution? If so, the privilege, if invoked, blocks the attempt.

A. *The Fourth Amendment*

Analysis under the Fourth Amendment of compelled neuroscience tests is fairly straightforward. The neuroscience tests fall within relatively clear and well-developed doctrinal rules that regulate the compelled production of evidence from suspects' bodies. Compelling such tests would be a "search" under the Court's "reasonable expectation of privacy"[159] test. Like other information about inner bodily processes such as the contents of one's blood or urine, subjects have a "reasonable expectation of privacy" in information about their brain states.[160] Moreover, the fact that the neuroscience tests measure brain details from outside the scalp does not destroy the analogy. One has a reasonable expectation of privacy in the details of one's home (even when measured from outside with a thermal-imaging device)[161] and in the contents of one's telephone conversations (even when gathered with an outside listening device).[162] Given these examples, one plainly also has a reasonable expectation of privacy in the details of what is in her head, even though the government doesn't have to invade the body to learn the information.[163] Because it is a "search" under the Fourth Amendment, such a test could be compelled if the government has probable cause

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privilege protects a subset of events not otherwise prohibited by the first-level inquiry. *Id.* Courts and scholars run into doctrinal and conceptual difficulties when they falsely assume that the two provisions diverge to protect different events or situations. This is demonstrated in *id.* at 1875–1902.

159. *See* Katz v. United States, 389 U.S. 347, 360 (1967) (Harlan, J., concurring).

160. Schmerber v. California, 384 U.S. 757, 766–72 (1966) (blood test); Skinner v. Ry. Labor Executives' Ass'n, 489 U.S. 602, 615–18 (1989) (urine test). Compelling a neuroscience test also appears to be a "seizure" because it would involve a show of authority (requiring the subject to sit for the test) followed by submission by the subject. *See* California v. Hodari D., 499 U.S. 621, 625–29 (1991).

161. Kyllo v. United States, 533 U.S. 27, 34–41 (2001).

162. Katz v. United States, 389 U.S. 347, 358–59 (1967).

163. Indeed, one might intuitively presume that the details in one's head are qualitatively *more* private than those regarding blood, urine, homes, and conversations such that a showing *beyond* probable cause should be required to be reasonable, or even that there should be an absolute ban on such evidence. *See, e.g.*, Boire, *supra* note 11. While I understand the intuitions that suggest a probable-cause-plus standard or even an absolute ban, the Supreme Court's precedents suggest that such a step would be unlikely. With regard to a probable-cause-plus standard, compare *Atwater v. City of Lago Vista*, 532 U.S. 318, 353–54 (2001), where the Court rejected a similar standard (suggested by Justice O'Connor, *id.* at 360–68) for full custodial arrests based on minor traffic violations. With regard to an absolute ban, the Court has systematically dismantled the idea of an "inviolable zone" in the criminal-procedure context (once suggested by *Boyd v. United States*, 116 U.S. 616, 633–38 (1886), *overruled by* Warden v. Hayden, 387 U.S. 294 (1967)). *See* Pardo, *Disentangling the Fourth Amendment and the Self-Incrimination Clause*, *supra* note 23, at 1872–79. Moreover, the intuitions suggesting such a standard for the neuroscience tests are, to some extent, based upon misconceptions regarding the nature of the evidence, which is clarified *supra* Part III.

and a warrant, or a recognized exception to these requirements.[164]

The Supreme Court's opinion in *Schmerber*, which involved a compelled blood test, is instructive.[165] In that case, the defendant was hospitalized after an automobile accident.[166] An officer at the hospital ordered a blood test of the defendant over the defendant's refusal.[167] The test was forcibly conducted, and the blood was analyzed for alcohol content.[168] The Court concluded that the compelled test was a search and seizure under the Fourth Amendment, but that because the human body is not "inviolate" against all forms of government evidence-gathering, such a test would be acceptable if supported by probable cause.[169] Probable cause existed because the officer smelled alcohol on the defendant's breath and observed his bloodshot eyes, and the Court found that a warrant was not required because the time needed to obtain one would allow the evidence to be destroyed.[170] The Court also noted that the test was reasonable because it was conducted in a safe manner with minimal risk, trauma, and pain.[171] Likewise, a compelled fMRI or "brain fingerprinting" test would measure information regarding internal bodily activity, in this case brain states. A suspect, therefore, could be compelled to take the test if probable cause exists to believe the test will reveal evidence, and the government obtains a warrant or a warrant exception applies. Moreover, the neuroscience tests appear to be less intrusive than a blood test; they are safe, relatively painless, and do not involve piercing the skin.

A more difficult, and troubling, question concerns whether the government can compel such tests via a grand-jury subpoena, which would not require the initial showing of probable cause. Consider a situation where the government obtains a grand-jury subpoena compelling twenty possible suspects to sit for a neuroscience test. Formally, the subpoenas may not be unreasonable, nor used to compel irrelevant evidence, nor to harass or burden a target.[172] Such protections, however, are feckless in practice, where

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164. *See* Wong Sun v. United States, 371 U.S. 471, 479–85 (1963); Warden, Md. Penitentiary v. Hayden, 387 U.S. 294, 298–99 (1967) (applying exigent circumstances exception to the warrant requirement); Illinois v. Lidster, 540 U.S. 419, 424 (2004) (applying special needs exception to the probable cause and warrant requirements to a roadblock); Bd. of Educ. v. Earls, 536 U.S. 822, 828–38 (2002) (applying "special needs" exception to school drug testing). Another newfangled kind of lie detector attempts to use thermal-imaging technology to measure heat coming off the eyes of suspects. For analysis of this technology under the Fourth Amendment, see George M. Dery, *Lying Eyes: Constitutional Implications of New Thermal Imaging Lie Detection Technology*, 31 AM. J. CRIM. L. 217, 242–44 (2004) (concluding that the use of thermal-imaging technology may not be a "search" when used on citizens in public because they voluntarily expose such heat to the public).

165. *Schmerber*, 384 U.S. at 758–59.

166. *Id.* at 758.

167. *Id.* at 758–59.

168. *Id.* at 759.

169. *Id.* at 767–69.

170. *Id.* at 768–70. This exigent-circumstances exception to the Fourth Amendment's warrant requirement was further established the next year in *Warden, Maryland Penitentiary v. Hayden*, 387 U.S. 294, 298–99 (1967).

171. *Schmerber*, 384 U.S. at 771.

172. *See* FED. R. CRIM. P. 17; United States v. Dionisio, 410 U.S. 1, 11–13 (1973); United States v. R.

the burden would be on the targets, not the government, to show that "there is *no reasonable possibility* that the *category* of materials the Government seeks will produce information relevant to the *general subject* of the grand jury's investigation."[173] It would be virtually impossible for a suspect to show that an fMRI or "brain fingerprinting" test would have no reasonable possibility of revealing relevant information about a general subject matter.

The Court's opinion in *Dionisio* provides an analogous situation.[174] In that case, twenty suspects were subpoenaed to provide a voice sample to the local U.S. Attorney's office.[175] The Court upheld the subpoena over a Fourth Amendment challenge brought by one of the targets, concluding that, despite any inconvenience or burden to the targets, the government need not make a showing of relevance because the grand jury's powers are necessarily broad and that a probable-cause showing was not necessary because the subpoena involved less "social stigma" than an arrest.[176] Similarly, the government would not need to make either a relevance or a probable-cause showing before rounding up the suspects for a neuroscience test, because such a test would also involve less "social stigma" than an arrest. For these reasons, Stephen Morse's sanguine statement that "it is clear that the government will not be able to use neuroscientific investigative techniques to go on "mental fishing expeditions"[177] may not necessarily be true—unless another provision in the Constitution picks up the slack.[178] The most likely candidate is the privilege against self-incrimination, which is discussed next.

Current doctrine aside, a better approach in these situations, and one that better accords with core Fourth Amendment practices and principles, would require the government to make some type of reasonableness showing. Because of a grand jury's need for broad investigatory powers,[179] and the less "stigma" involved with a subpoena,[180] the showing need not be

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Enters., Inc., 498 U.S. 292, 299 (1991) (noting the government cannot "engage in arbitrary fishing expeditions").

173. *R. Enters.*, 292 U.S. at 301 (emphasis added).

174. *Dionisio*, 410 U.S. at 1.

175. *Id.* at 3.

176. *Id.* at 10–13.

177. Morse, *supra* note 97, at 188. *See also* Keckler, *supra* note 11 ("The level of suspicion required for involuntary questioning by fMRI would presumably be at minimum that required for any form of custodial interrogation.").

178. As explained in more detail in Pardo, *Disentangling the Fourth Amendment and the Self-Incrimination Clause*, *supra* note 23, at 1881–90, this gap in Fourth Amendment doctrine best explains the Court's mistaken transposition of a "government knowledge" inquiry into its analysis of whether the privilege against self-incrimination protects subpoena targets from compelled production. The Court's strange requirements in *Fisher v. United States*, 425 U.S. 391, 411 (1976), and *United States v. Hubbell*, 530 U.S. 27, 33 (2000), that the relevant information must not be a "foregone conclusion" (*Fisher*) or described with "reasonable particularity" (*Hubbell*) appear to work to prevent the "fishing expeditions" that should be protected by the Fourth Amendment. Nowhere else does the scope of the Fifth Amendment privilege turn on what the government knows.

179. *See* H. Richard Uviller, *Foreword: Fisher Goes on the Quintessential Fishing Expedition and Hubbell Is off the Hook*, 91 J. CRIM. L. & CRIMINOLOGY 311, 321–22, 334–35 (2001).

180. *Dionisio*, 410 U.S. at 3–7, 10–13.

one of probable cause. The Fourth Amendment already accommodates such needs for lower standards, for example, by requiring only reasonable suspicion for brief, investigative stops.[181] A similar standard in this situation could prevent arbitrary "fishing expeditions" as well as prevent burdening or harassing innocent targets.[182]

B. *The Self-Incrimination Clause*

This section first analyzes the neuroscience evidence and then uses the analysis and examples discussed to test other proposed theories of the privilege against self-incrimination.

1. Neuroscience Evidence and Self-Incrimination

Whether the privilege against self-incrimination would prohibit forcing suspects to submit to neuroscience tests presents a more difficult question. In practice, the privilege prohibits (1) compelled, (2) incriminating, (3) testimonial communications, and these three formal elements structure the analysis. With regard to the neuroscientific evidence, the first two elements are relatively straightforward, and the third presents a difficult question.

The first element—compulsion—refers to government conduct that causes a suspect to make statements. Whether conduct is "compulsion" or not turns on the permissibility of the kinds of conduct involved, not necessarily the pressure placed on suspects. Clear examples of compulsion include threats of contempt for not testifying or threats of violence for not confessing.[183] By contrast, offers of favorable plea agreements or trickery to induce statements are not compulsion. For purposes of my analysis, requiring the neuroscience tests would, by hypothesis, be compulsion. I am assuming that subjects are being forced to submit to the tests, either by physically restraining them and conducting it (as in *Schmerber*) or by subpoenaing them to submit with a threat of contempt for noncompliance.

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181. Terry v. Ohio, 392 U.S. 1, 16–27 (1968).

182. One district court has required a similar standard in response to a subpoena for blood and saliva. *See* Henry v. Ryan, 775 F. Supp. 247, 254 (N.D. Ill. 1991) ("[A] grand jury subpoena for physical evidence must be based on individualized suspicion."). Most other district courts, however, have applied the basic standard that applies to any other grand-jury subpoena. *See, e.g.*, United States v. Garcia-Ortiz, No. Civ. 01-111(DRD), 2005 WL 3533322, at *8 (D.P.R. Dec. 23, 2005); United States v. Swanson, 155 F. Supp. 2d 992, 1002 (C.D. Ill. 2001); *In Re* Grand Jury Proceedings Involving Vickers, 38 F. Supp. 2d 159, 164 (D.N.H. 1998). One district court, by contrast, has required "probable cause" for a grand-jury subpoena for a blood sample. *In re* Grand Jury Proceedings (T.S.), 816 F. Supp. 1196, 1200 (W.D. Ky. 1993). The Supreme Court has never required a higher standard under the Fourth Amendment for subpoenas for bodily fluids. *See also* Floralynn Einesman, *Vampires Among Us—Does a Grand Jury Subpoena for Blood Violate the Fourth Amendment?*, 22 AM. J. CRIM. L. 327 (1995).

183. *See also* Griffin v. California, 380 U.S. 609, 612–15 (1965) (reversing conviction where prosecutor referred to defendant's invocation of the privilege as an indication of guilt); Lefkowitz v. Turley, 414 U.S. 70, 82–84 (1973) (striking down state statute that required state contracts to contain a clause that contractors waive their right to invoke the self-incrimination privilege with regard to subject matter relating to the contract).

The second element—incrimination—refers to whether the compelled information will be used in a criminal prosecution against the subject, either directly or to derive other evidence. "Incrimination" is construed broadly to include any evidence that reasonably "could be used in a criminal prosecution or could lead to other evidence that might be so used."[184] "Incrimination," and hence the privilege, does not apply when subjects are granted immunity;[185] when the information would lead to non-criminal sanctions only, such as loss of a job or a license or to disgrace or embarrassment; or when the information is sought to incriminate a third party, including friends and family.[186] Therefore, the compelled neuroscience tests would fall within these rules: the incrimination element would be met when the results could lead to evidence used in a criminal prosecution; subjects could not invoke the privilege when they are granted immunity, face non-criminal sanctions only, or the test results are sought to incriminate a third party.

The third element—testimony—is less clear. Two principles help to delineate this variable. First, "testimonial" or "communicative" evidence is often contrasted with "real" or "physical" evidence. *Schmerber* drew this distinction explicitly in concluding that the compelled blood test did not implicate the privilege against self-incrimination: "The distinction which has emerged, often expressed in different ways, is that the privilege is a bar against compelling 'communications' or 'testimony,' but that compulsion which makes a suspect or accused the source of 'real or physical evidence' does not violate it."[187] To this end, in addition to blood tests, the privilege does not apply to other compelled evidence from a suspect's body such as hair, fingerprints, and breathalyzer tests;[188] to voice[189] and handwriting[190] exemplars (because physical characteristics are what is relevant); and to orders to appear in a lineup[191] or to try on clothing.[192]

The second principle for delineating this variable is that "testimonial communications" for purposes of the privilege are not limited to verbal or written acts by suspects. The Court's subpoena cases are illustrative. The act of responding to a subpoena by providing a requested object or document discloses one's (1) knowledge that the object exists, (2) possession of it, and (3) belief that the provided object is the one demanded.[193] In other words, the requested objects or documents are not protected, but the "testimonial" acts of production are protected. In *Fisher v. United States*,

184. Kastigar v. United States, 406 U.S. 441, 445 (1972).

185. *Id.* at 445–47.

186. *See* Ullmann v. United States, 350 U.S. 422, 430–31 (1956).

187. Schmerber v. California, 384 U.S. 757, 764 (1966).

188. *Id.* at 760–65.

189. United States v. Dionisio, 410 U.S. 1, 5–7 (1973).

190. United States v. Mara, 410 U.S. 19, 21–22 (1973).

191. United States v. Wade, 388 U.S. 218, 221–23 (1967).

192. Holt v. United States, 218 U.S. 245, 252–53 (1910).

193. Fisher v. United States, 425 U.S. 391, 410–11 (1976).

for example, the Court held that responding to a subpoena for tax documents did not implicate the privilege because the government already knew of the existence and location of the documents; therefore, the defendant did not use the defendant's testimonial communications.[194] By contrast, in *United States v. Hubbell*, the Court found that the privilege did apply to a request for thousands of documents that the government could not describe with particularity because the government made use of the "contents of [Hubbell's] mind" and thus his testimonial communications.[195]

From these two principles the scope of "testimonial communications" may be articulated in the following rule: the government may not compel for use as evidence the content of a suspect's propositional attitudes. Propositional attitudes are mental states such as beliefs, thoughts, doubts, hopes, wishes, desires, knowledge, and so on, toward propositions.[196] Two examples of propositional attitudes are a subject's belief that *so and so* is the case (e.g., that the victim was out of town during the robbery) or knowledge that *such and such* is the case (e.g., that the subject robbed the house). When the government uses the informational content of those propositions (in other words, the "*so and so*" and "*such and such*"), the testimony variable is satisfied.[197]

Two additional examples help to further flesh out this rule and the related principles. First, consider a psychiatric examination used during a capital-sentencing proceeding in order to determine future dangerousness. In *Estelle v. Smith*, the Court held that a defendant's statements made during the examination were "testimonial" because "the State used as evidence against respondent the *substance* of his disclosures."[198] Specifically, the

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194. *Id.* *See also Doe v. United States*, 487 U.S. 201, 202–03 (1988), where a target of a grand-jury subpoena was directed to sign a form releasing details regarding any foreign bank accounts in his name, without admitting their existence. The Court concluded that the privilege did not apply because the act of signing the form did not invoke "testimonial aspects," *id.* at 209, of production: "By signing the form, Doe makes no statement, explicit or implicit, regarding the existence of a foreign bank account or his control over any such account." *Id.* at 215–16. The Court explained that the policies behind the privilege are "to spare the accused from having to reveal, directly or indirectly, his knowledge of facts relating him to the offense or from having to share his thoughts and beliefs with the Government." *Id.* at 213.

195. 530 U.S. 27, 43 (2000) (quoting Curcio v. United States, 354 U.S. 118, 128 (1957)). *See also United States v. Doe*, 465 U.S. 605, 612–17 (1984), where the Court concluded that a grand-jury target's acts of producing business records in response to a subpoena qualified as "testimonial" because they would reveal the existence and authenticity of the documents.

196. *See* A COMPANION TO THE PHILOSOPHY OF LANGUAGE 679 (Bob Hale & Crispin Wright eds., paperback ed. 1999).

197. The above analysis follows Allen & Mace's descriptive account of the privilege, *supra* note 17, at 246–47, which explains the privilege as applying to "the substantive content of cognition" and "the propositions with truth-value that people hold." Under the rule articulated above, the privilege also would extend to a person's false beliefs (for example, a defendant's false belief that a victim named the defendant as the beneficiary of her will), and to those that are neither true nor false (for example, if the content were used to identify the person as the culprit of a crime). *See also* Uviller, *supra* note 179, at 325 n.50 (privilege protects "a person's sovereignty over the contents of his mind."). But the privilege does not protect a suspect's mental sovereignty when that person has been granted immunity or the content is being compelled to incriminate a third party.

198. 451 U.S. 454, 464–65 (1981) (emphasis added). The substance of the defendant's disclosures is

testifying psychiatrist reached the conclusion that the defendant was a "severe sociopath" and that he will "commit other similar or same criminal acts" based on the defendant's account of his previous crime during the examination.[199] Second, consider a suspect asked whether he knows the date of his sixth birthday in order to determine the extent of his intoxication. In *Pennsylvania v. Muniz*, the Court had to determine whether an answer to this question (in this case, "No, I don't [know].") qualified as testimonial (along with other compelled evidence such as field-sobriety tests and biographical information elicited during booking).[200] Although the Court ended up concluding the sixth-birthday question was covered by the privilege against self-incrimination, it did not decide whether it was "testimonial." Four justices concluded that it was testimonial;[201] four justices concluded it was not;[202] and Justice Marshall rejected the testimonial/non-testimonial distinction and concluded that the privilege should apply to all the evidence regardless of its testimonial qualities (thus providing the fifth vote of the sixth-birthday question).[203] Under the above rule, however, the question and its answer would not be "testimonial" because the *content* of the answer would not be incriminating; the question would only test the defendant's mental acuity at the time, which may be incriminating for reasons other than content.[204] In sum, the psychiatric examination in *Estelle* and the sixth-birthday question in *Muniz* provide an example on each side of the "testimonial" line.

This rule and related principles now illuminate when the privilege would apply to the compelled use of the neuroscience tests. Namely, it would apply when the government compels the tests in order to obtain evidence of the incriminating informational content of subjects' propositional attitudes. Thus, even though the tests gather physical evidence from the

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the content of what he said. *Id.*

199. *Id.* at 459–60.

200. 496 U.S. 582, 586 (1990).

201. *Id.* at 593–601.

202. *Id.* at 607–08 (Rehnquist, C.J., concurring in part and dissenting in part).

203. *Id.* at 616, 616 n.4 (Marshall, J., concurring in part and dissenting in part) ("I believe [the] privilege extends to *any* evidence that a person is compelled to furnish against himself." (emphasis added)). Although the "testimonial" requirement appears to be firmly entrenched in current doctrine, Justice Thomas (joined by Justice Scalia) recently has expressed a willingness to consider whether, based on historical grounds, the privilege should be extended to non-testimonial evidence as well. United States v. Hubbell, 530 U.S. 27, 49–56 (2000) (Thomas, J., concurring). Richard Nagareda has argued that this more expansive view of the privilege would better accord with the original understanding of the phrase "to be a witness" in the Fifth Amendment, which he argues meant "to give evidence" not just "testimonial communications." *See* Richard A. Nagareda, *Compulsion "to Be a Witness" and the Resurrection of Boyd*, 74 N.Y.U. L. REV. 1575, 1603 (1999). Akhil Amar and Renee Lettow, by contrast, argue in favor of the "testimonial" limitation on historical, original-understanding grounds. *See* Akhil Reed Amar & Renee B. Lettow, *Fifth Amendment First Principles: The Self-Incrimination Clause*, 93 MICH. L. REV. 857, 919 (1995) ("Unlike some state constitutions, such as the Massachusetts Constitution of 1780, the Fifth Amendment does not prohibit the government from compelling a defendant to 'furnish evidence against himself.'").

204. Allen & Mace, *supra* note 17, at 272–77 reach a similar conclusion and provide further analysis of *Muniz*.

subjects' bodies, unlike other physical tests and like "testimonial acts of production," the tests may provide inductive evidence of their beliefs, knowledge, and other mental states. When the government attempts to make evidential use of the propositional content of such states, the privilege applies; when it does not, the privilege does not apply.[205]

Four examples (two for each kind of test) help to elucidate this distinction.

Example 1: Winston is a suspect in a bank robbery. Winston denies involvement. The government (either with probable cause and a warrant or via subpoena) wants to compel Winston to sit for an fMRI test in order to ask him questions about his involvement in the crime. If the results of the test are consistent with deception, the government plans to uses the results at trial as evidence of guilt, or to gather further evidence against Winston.

Example 2: Alex is arrested for criminal fraud. Upon his arrest, his attorney claims that Alex lacked the mental capacities necessary to engage in such conduct. The government wants to compel Alex to sit for an fMRI test in order to use the results as evidence that, during Alex's answers, his brain triggered the neurological correlates consistent with deception, and thus that he can engage in such conduct.[206]

Example 3: Winston, still suspected of bank robbery, is now compelled to sit for the "brain fingerprinting" test. He is shown images of the bank vault (which only employees and the robbers have seen) and presented with details of the crime. The government wants to introduce the test results, which suggest prior knowledge when presented with the images and details, as evidence of Winston's guilt.

Example 4: Alex, still suspected of fraud, claims that he has a short-term memory problem that explains his conduct (rather than an intent to commit fraud). The government compels Alex to sit for the "brain fingerprinting" test. They first present him with some details and, after a short period of time, test him to see if the results suggest "knowledge" when he's again presented with the details. The government wants to offer the results as evidence of guilt, arguing they show that Alex did recognize the details and thus does not have the memory problems he claims.

In these examples, Winston would be able to invoke the privilege while Alex would not.[207] In the Winston examples, the tests are relevant in order to generate the incriminating content of Winston's beliefs or knowl-

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205. This would mean, then, that the privilege would not preclude compelled tests when used for any purpose other than those that rely on incriminating propositional content. For example, if the tests could be used to determine mental capacity, intent, bias, voluntariness, etc., without relying on incriminating propositional content, then the privilege would not preclude such uses.

206. This example is based on one suggested in O'Hara, *supra* note 5.

207. This is so even though Winston in example # 3 was not required to provide a verbal response. In either case, FED. R. EVID. 704 would prevent an expert from offering an opinion in a criminal case on "whether the defendant did or did not have the mental state or condition constituting an element of the crime charged or a defense thereto."

edge. The evidence of deception is relevant because it provides evidence of Winston's belief that he was involved in the crime; the "brain fingerprinting" evidence is relevant because it provides evidence of Winston's knowledge of the crime scene and details of the crime. By contrast, the Alex examples do not involve attempts to use the incriminating informational content of Alex's mental states. Both tests provide evidence, rather, of Alex's mental capacities; the fact that he has such brain states is evidence of cognitive capacities, not propositional content. This makes the tests more like other compelled tests where physical details are relevant such as blood tests and handwriting and voice exemplars, and not like testimony. These results appear to be consistent with the Court's dicta in *Schmerber* that a compelled polygraph, while measuring physical details, may still be testimonial: "Some tests seemingly directed to obtain 'physical evidence,' for example, lie detector tests measuring changes in body function during interrogation, may actually be directed to eliciting responses which are essentially testimonial."[208] To the extent the neuroscience tests are so directed, the privilege applies.[209]

2. Theoretical Accounts of the Privilege

The neuroscience-test examples provide powerful counter-examples to other theories that purport to explain the scope of the privilege against self-incrimination. Unlike my analysis—which extended the privilege to the neuroscience tests when used to compel the incriminating content of a suspect's propositional attitudes—other prominent theories of the privilege would allow for more widespread use. Therefore, the hypothetical neuroscience examples serve an important analytical purpose in testing theoretical accounts of the privilege. If the reader is convinced that the privilege would apply to some uses of the neuroscience tests, then the following four theories fail to the extent that they cannot explain this result and would not extend the privilege to the compelled neuroscience tests. In other words, the hypothetical Winston and Alex would *both* be unable to invoke the privilege under these theories.

First, Richard Nagareda argues that the privilege protects against a certain "means" of evidence gathering, namely, "the compelled giving of self-incriminatory evidence to the government (categorically impermissible under the Fifth Amendment)" as opposed to "the unilateral taking of such evidence by the government (permissible, when done in compliance with

208. Schmerber v. California, 384 U.S. 757, 764 (1966).

209. When it does, the other corollaries to the privilege attach as well. *See, e.g.*, Griffin v. California, 380 U.S. 609, 612–15 (1965) (prosecution may not make evidentiary use of defendant's invocation of the privilege); Baxter v. Palmigiano, 425 U.S. 308, 316–20 (1976) (adverse inferences may be drawn in non-criminal proceedings against parties who invoke the privilege); California v. Byers 402 U.S. 424, 427–34 (1971) (privilege non-applicable to mandatory automobile-accident disclosures because required to facilitate non-criminal regulatory regime); Baltimore City Dep't of Soc. Servs. v. Bouknight, 493 U.S. 549, 554–59 (1990) (privilege inapplicable to guardian requirements in order to facilitate non-criminal social-services administration).

the Fourth)."[210] The distinction between "compelled giving" and "unilateral taking" cannot explain, and hence would appear to withhold the privilege from, at least one type of neuroscience test. This theory would authorize the government to use the "brain fingerprinting" test in every circumstance because the suspect is not required to give answers and the results can be "unilaterally taken" by the government, as could blood samples.[211]

Second, Akhil Amar and Renee Lettow argue that the privilege may be justified by a reliability principle.[212] Therefore, under this normative theory, they argue that current doctrine should be restructured to fit its reliability rationale.[213] Most notably, they suggest that suspects should be compelled to answer questions under oath in pre-trial proceedings, with possible contempt charges for refusal; their statements would be inadmissible, but any physical evidence or testimony their statements led to would be admissible.[214] The rationale for excluding statements (but not the other evidence) is their unreliability:

> Compelled testimony may be partly or wholly misleading and unreliable; even an innocent person may say seemingly inculpatory things under pressure and suspicion and when flustered by trained inquisitors. But physical fruit is far more sturdy and reliable evidence, so it should be brought before the jury.[215]

Their theory would, therefore, allow use of both types of neuroscience tests under any circumstances once they reached a sufficient level of reliability. The test results would be physical evidence; and even when offered as evidence of the contents of mental states, the reliability of the tests would necessarily remove the unreliability rationale for excluding such evidence.[216]

Third, consider the recent "anti-pooling" theory of the privilege put forward by Daniel Seidmann and Alex Stein.[217] They argue that the privilege protects innocent defendants because, in the absence of a privilege, guilty defendants would offer lies, thus pooling with innocent defendants

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210. Nagareda, *supra* note 203, at 1581.

211. *See Schmerber*, 384 U.S. at 760–65.

212. Amar & Lettow, *supra* note 203, at 928 ("Finders of fact in criminal cases should not be deprived of reliable, highly probative evidence.").

213. *Id.* at 898–901.

214. *Id.* at 899–900 ("Physical evidence, on the other hand, can be introduced at trial whatever its source—even if that source is a compelled pretrial utterance.").

215. *Id.* at 900–01. *See also id.* at 925–26 ("Reports of interior mental states are easily misunderstood, notoriously imprecise (depending on a person's mood when reporting), and hard to verify.").

216. The authors may agree that the privilege should not apply to these compelled tests; the beauty of top-down, normative theories is that one can always revise any practices to fit the desired theory. Although to the extent one accepts the practices as sound (for example, extending the privilege to some compelled uses of the neuroscience tests), then the problem is with the theory that cannot explain those practices.

217. Daniel J. Seidmann & Alex Stein, *The Right to Silence Helps the Innocent: A Game-Theoretic Analysis of the Fifth Amendment Privilege*, 114 HARV. L. REV. 430 (2000). This "anti-pooling" theory is discussed in further detail in ALEX STEIN, FOUNDATIONS OF EVIDENCE LAW 158–64, 200–04 (2005).

and lowering the credibility (and hence value) of the innocents' statements.[218] The availability of the privilege causes some guilty defendants to invoke it and thus prevents their pooling with statements made by innocent defendants.[219] Seidmann and Stein argue that this rationale both justifies the privilege and can explain its doctrine.[220] But the "anti-pooling" rationale would appear to authorize the neuroscience tests in all circumstances, again assuming sufficient reliability, because the results are involuntary and thus the game-theoretic choices that lead to the undesirable pooling could not be made.

Fourth, and finally, even the oft-cited "cruel trilemma" rationale—which protects suspects from choosing between self-incrimination, perjury, or contempt—may not apply the privilege to the neuroscience evidence.[221] In the context of lie detection, for example, George Dery has employed the "cruel trilemma" framework to conclude that the use of a thermal-imaging device to measure heat off of a subject's face would fall within the scope of the privilege.[222] He reaches this conclusion by analogizing to a similar three-prong choice a suspect would be forced to make: admitting incriminating information, lying and trying to bluff the machine, or refusing to answer and drawing suspicion on himself.[223] Such a "cruel choice," however, may not be available with regard to the neuroscience tests. According to the neuroscientists, the brain states measured by the fMRI test are involuntary and not under a subject's control; indeed, this is why they posit that the test would be superior to a traditional polygraph machine (which measures physiological functions a person may learn to control).[224] Therefore, the option of "bluffing" the machine may not be available.[225] Additionally, under the "brain fingerprinting" test, there would be even less choice because the tests would not require the subject to provide answers. Thus, this rationale, like the above three theories, would authorize the use of reliable neuroscience tests under most, if not all, circumstances.

By contrast, my analysis of the privilege's scope explains when and why the privilege would protect the compelled neuroscience tests: the privilege protects the incriminating use of the content of one's propositional atti-

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218. Seidmann & Stein, *supra* note 217, at 451–74.

219. *Id.* at 468–70.

220. *Id.* at 474–502.

221. The source of the phrase was Justice Goldberg's opinion in *Murphy v. Waterfront Commission*, 378 U.S. 52, 55 (1964). The Court recently cited this rationale again in *Chavez v. Martinez*, 538 U.S. 760, 767 (2003).

222. Dery, *supra* note 164, at 248.

223. *Id.* at 248. As explained *infra* at p. 34, this cruel-choice rationale is also over-inclusive in that it would extend the privilege to compelled evidence outside of its current scope, for example, handwriting, voice, and urine samples.

224. *See* Lee et al., *supra* note 38, at 163 ("[I]t is also clearly evident that controlling one's cerebral activity to avoid detection is unfeasible.").

225. It might be argued that under this test, the suspect would still have a choice to answer or not, but this binary choice of compliance or not applies to all compelled evidence. Even those subject to a search warrant have to comply during the search.

tudes. Each of the alternative theories fails to the extent it would allow the compelled use of neuroscience tests in order to discover the incriminating propositional content of a suspect's mind.[226]

C. Due Process

In addition to the Fourth and Fifth Amendments, substantive and procedural due process also regulate government evidence gathering. But neither would prevent the compelled use of reliable neuroscientific evidence. The Court has recently clarified that government conduct that does not constitute a violation under the Fourth or Fifth Amendments may still constitute a violation of substantive due process if it is so outrageous that it "shocks the conscience."[227] For example, the Court explained that this standard might have been met when a police officer allegedly denied medical treatment in an ambulance to a suspect, who had been shot, as an attempt to extract a confession.[228] The neuroscience tests, however, would not meet this standard because they are relatively safe and painless—indeed more so than a compelled blood test, which does not violate this standard.[229] Procedural due process also provides some support for excluding involuntary confessions because of their unreliability.[230] But if the neuro-

226. *See supra* note 150 and accompanying text.

227. Chavez v. Martinez, 538 U.S. 760, 774 (2003) (Thomas, J., concurring) (quoting Rochin v. California, 342 U.S. 165, 172 (1952)).

228. *Id.* at 763–64 (Thomas, J., announcing judgment of Court); *Id.* at 779 (Souter, J., concurring); *Id.* at 779–80 (Souter, J., announcing judgment of Court).

229. Schmerber v. California, 384 U.S. 757, 758–59, 767–71 (1966). PET scans, which are significantly more invasive, are less likely to be compelled. *See* Functional MRI Research Center, Columbia University, *supra* note 26. The fMRI tests might also be available in certain circumstances during civil discovery. *See* FED. R. CIV. P. 35. Whether the Constitution would place any restrictions on the use of such tests for government purposes outside of criminal prosecutions, such as intelligence gathering or other military purposes, is outside the scope of this article. The use of reliable neuroscience tests, however, may have beneficial effects in such information-gathering contexts: it may lead to better information; it may lead to quicker determinations of who does and does not have information (perhaps shortening the detention of innocent suspects who have answered honestly); the fact that the tests are safe and painless may lessen the need to employ more cruel (possibly abusive, not to mention, less reliable) interrogation techniques. A recent student article concludes that the compelled use of similar fMRI tests on detainees may violate international human-rights laws. Sean Kevin Thompson, Note, *The Legality of the Use of Psychiatric Neuroimaging in Intelligence Interrogation*, 90 CORNELL L. REV. 1601 (2005). Also outside the scope of this article is whether a general First Amendment right to "freedom of thought" would be implicated by these tests. *See* Palko v. Connecticut, 302 U.S. 319, 326 (1937), *overruled on other grounds by* Benton v. Maryland, 395 U.S. 784, 793–94 (1969); *see also* Boire, *supra* note 11 (arguing for a right of "cognitive liberty"). In general, the Supreme Court has refused to provide extra protection in the criminal-procedure context for evidence gathering that implicates First Amendment concerns. *See* Zurcher v. Stanford Daily, 436 U.S. 547, 565 (1978) (typical Fourth Amendment standards apply to search of newspaper office); Branzburg v. Hayes, 408 U.S. 665, 667 (1972) ("The issue in these cases is whether requiring newsmen to appear and testify before state or federal grand juries abridges the freedom of speech and press guaranteed by the First Amendment. We hold that it does not."); *but see* Tattered Cover, Inc. v. City of Thorton, 44 P.3d 1044, 1055–56 (Colo. 2002) (holding that, when First Amendment rights are at issue, Colorado Constitution requires a more substantial justification for use of a search warrant than typical Fourth Amendment standards require).

230. *See* Mark A. Godsey, *Rethinking the Involuntary Confession Rule: Toward a Workable Test for Identifying Compelled Self-Incrimination*, 93 CAL. L. REV. 465, 485–99 (2005).

science tests reach a sufficient level of reliability, then this supplementary protection based on procedural due process will be unavailable as well.[231]

V. Conclusion

Neuroscience may soon provide the law with admissible, probative evidence of deception, and with powerful investigative tools. The law must anticipate and respond to the proposed neuroscience evidence with a clearly articulated understanding of the nature of the evidence and a clearly articulated sense of its constitutional implications and limitations.[232] This article has attempted to further those ends.

231. Indeed, if the tests reach a sufficient level of reliability, defendants will likely have a constitutional right to be able to present such evidence suggesting their innocence. *See* United States v. Scheffer, 523 U.S. 303, 314 & n.9 (1998) (concluding that a rule categorically excluding polygraph evidence did not violate a constitutional right to present a defense because of the technique's questionable reliability).

232. Wolpe, *supra* note 10, at 47 ("Society must be ready to come to a decision about the value of cognitive privacy before these technologies become widespread."). If extant constitutional protections prove to be inadequate, additional statutory protections may be necessary. *See* Henry T. Greely, *Premarket Approval Regulation for Lie Detections: An Idea Whose Time May Be Coming*, AM. J. BIOETHICS, Mar.-Apr. 2005, at 50.