
**ABSOLUTE TRUTH OR DEUS EX MACHINA?: THE LEGAL AND
PHILOSOPHICAL RAMIFICATIONS OF GUILT-ASSESSMENT
TECHNOLOGY**

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"[Y]ou must understand, sir, that a person is either with this court or he must be counted against it, there be no road between. This is a sharp time, now, a precise time—we live no longer in the dusky afternoon when evil mixed itself with good and befuddled the world. Now, by God's grace, the shining sun is up, and them that fear not light will surely praise it."

- ARTHUR MILLER, *THE CRUCIBLE*, 76 (Heinemann 1992) (1953).

I. Introduction

On June 12, 2008, a court in India convicted Aditi Sharma of murdering her fiancé and sentenced her to life in prison.¹ As its primary evidence against her, the court relied on a brain scan test that purported to show that Sharma's brain held knowledge of the crime that only the killer's brain could contain.² Research-

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¹ Anand Giridharadas, *India's Use of Brain Scans in Courts Dismays Critics*, INT'L HERALD TRIB., Sept. 15, 2008, *archived at* <http://www.webcitation.org/5g24fzKdj>.

² *Id.* J. Peter Rosenfeld, a psychologist and neuroscientist at Northwestern University who was among the first to begin developing electroencephalogram-based lie detection, was troubled over India's heavy reliance on such an unproven technology to convict Sharma of murder. *Id.* Henry Greely, a bioethicist at Stanford Law School, also expressed deep concern over the verdict, stating that with respect to the utilization of lie detection technology, "we need to demand the highest standards of proof before we can ruin people's lives based on its application." *Id.*

ers in the United States have expressed strong opposition to this verdict, noting that the technology employed is far from perfect and should not have been relied upon in this manner.³

Since the first vestiges of societal establishment, we have struggled with not only how to punish those who do wrong, but how to determine the identity of the wrongdoer.⁴ In the earliest Anglo-American trials, the relied upon means of assessing the guilt of the accused was not a trial by his peers, but one under God.⁵ Under *judicium Dei*, the accused was either subjected to some form of torture, as in trial by ordeal, or to trial by combat.⁶ These two forms of “trial” shared the same inspiration: God would not let an innocent suffer, and if the accused were truly not guilty, He would intervene on his behalf.⁷

The commonality that *judicium Dei* shares with modern attempts at guilt assessment by technological means is that the responsibility for deciding the accused’s fate is placed not upon society, but rather on some third party—in the latter case, a machine. Ben Clark, of the Notre Dame University of Australia School of Law, wonders whether in the creation of lie detection technology we have not merely “invented a modern form of witch dunking.”⁸

However, although in its present state such technology is not foolproof—claims of accuracy at detecting deception hover

³ *Id.* In this case, a technique known as a “Brain Electrical Oscillations Signature” test (BEOS), was employed. This technology, developed by Indian neuroscientist Champadi Raman Mukundan, is similar to the “Brain Fingerprinting” technology promoted by Dr. Lawrence Farwell. *Id.* For a description of how Brain Fingerprinting works, see *infra* note 45, and accompanying text.

⁴ See Laurie C. Kadoch, *So Help Me God: Reflections on Language, Thought, and the Rules of Evidence Remembered*, 9 RUTGERS J.L. & RELIGION 2, 3 (2007) (describing the evolution of the Rules of Evidence).

⁵ *Id.* (noting God’s continuing place in trial).

⁶ See *id.* at 27-28, 31.

⁷ *Id.*

⁸ Ben Clark, *Trial by Ordeal? Polygraph Testing in Australia*, 7 MURDOCH U. ELEC. J.L. (2000) archived at <http://www.webcitation.org/5ex1t3QKF>.

around ninety percent⁹—the benefits cannot be ignored. Laboratory tests have shown people to be very poor lie detectors, with success rates averaging that of pure chance.¹⁰ Thus on its face, with the primary purpose of our legal system to separate the guilty from the innocent, any device that allows us to do so with better accuracy should be embraced. In actuality, the issue is far more complicated, and many fear that the general acceptance of lie detection evidence—or that of any other “mind reading” technology—will unleash an Orwellian nightmare. Is it possible to utilize this technology to achieve the most accurate fact-finding possible without completely usurping the role of the jury and the ideals for which the jury system stands?

In Part II of this article, I will explore the history of scientific evidence generally, as well as how the admission standards of the judicial system have adapted with the introduction of new technologies. I will then look more specifically at the history of lie detection, including emerging neuroscience technologies and how they have been both employed and dismissed by the courts. In Part III, I will broadly articulate the areas in which the use of neuroscience technologies conflicts or raises issues with the judicial process, particularly with respect to the role of the jury. Finally, in Part IV, I will examine the pros and cons of judicial utilization of these technologies, as well as the broader philosophical implications of doing so.

II. History

A. Admission of scientific evidence generally

Scientific evidence can provide a solid foundation for proving a given point in a case, thereby reducing the variables that must be considered by the jury and lessening the possibility

⁹ Ishani Ganguli, *Watching the Brain Lie*, THE SCIENTIST, May 1, 2007, at 41, available at 2007 WLNR 9021759.

¹⁰ Danielle Andrewartha, *Lie Detection in Litigation: Science or Prejudice?*, 15 PSYCHIATRY, PSYCHOL. & L. 88 (Austl. Acad. Press 2008), available at 2008 WLNR 25559791; Bella DePaulo at the University of California, Santa Barbara puts the success rate at 47%. Ganguli, *supra* note 9, at 41.

of error. For the majority of the 20th century, the admission of scientific evidence was governed by the rule established in *Frye v. United States*.¹¹ *Frye*, decided in 1923, put forth the standard that in order for scientific evidence to be admissible in a court of law, the method by which that evidence was procured must be “sufficiently established to have gained general acceptance in the particular field in which it belongs.”¹²

In 1976, the Federal Rules of Evidence (FRE)¹³ were adopted, taking a far more liberal stance on what scientific evidence could be admitted.¹⁴ Specifically, Rules 702 and 703 consolidated admission requirements for scientific evidence and expert testimony by asking: (1) whether or not the evidence would aid in settling a certain question of fact; (2) whether the witness had sufficient expertise in his area; and (3) if the data that the witness were relying upon would not be admissible alone, if that data could be reasonably relied upon by experts in the field.¹⁵

In 1993, in its ruling of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,¹⁶ the Supreme Court acknowledged and sought to reconcile the polar admissibility standards of *Frye* and the FRE.¹⁷ To that end, the Court established a two-pronged analysis for judges to employ in determining whether to admit scientific evidence or expert testimony.¹⁸ First, the judge must decide whether the expert’s testimony is in fact to be considered “scientific

¹¹ 293 F. 1013, 1014 (D.C. Cir. 1923); Lisa Gonzalez, *The Admissibility of Scientific Evidence: The History and Demise of Frye v. United States*, 48 U. MIAMI L. REV. 371, 372 (1993).

¹² *Frye*, 293 F. at 1014 (holding evidence obtained by crude lie detection device not admissible due to lack of scientific recognition).

¹³ Julie A. Singer et al., *The Impact of DNA and Other Technology on the Criminal Justice System: Improvements and Complications*, 17 ALB. L.J. SCI. & TECH. 87, 120 (2007).

¹⁴ *Id.* at 120-21.

¹⁵ Gonzalez, *supra* note 11, at 376-77. In particular, the FRE factor of reasonable reliance on the data by the expert was a considerable departure from the general acceptance standard required by *Frye*. Gonzalez, *supra* note 11, at 376-77.

¹⁶ 509 U.S. 579, 579 (1993).

¹⁷ Singer, *supra* note 13, at 121.

¹⁸ See *Daubert*, 509 U.S. at 579.

knowledge,” whether the findings themselves are “derived by the scientific method,” and whether the work can be considered “good science.”¹⁹ The second prong, which the Court referred to as the “fit” requirement, obliges proffered testimony to be relevant to a material portion of the advancing party’s case.²⁰

In addition to the two-pronged test, the Court also listed several factors to provide further guidelines for whether or not a judge should admit expert scientific testimony under Rule 702.²¹ These factors included: whether or not the methodology employed by the expert is generally accepted by the scientific community, whether that methodology has been subjected to peer review and publication, the degree to which it has been tested, and whether the associated rate of error is acceptable.²²

The task before judges in their post-*Daubert* “gatekeeping role”²³ is a difficult one. Not only must they decide whether or not scientific evidence should be admitted, but also who has the necessary expertise to testify about that evidence and what that testimony may entail.²⁴ Further, and perhaps most importantly, the judge must also weigh the prejudicial effect the evidence could have upon the jury against the probative value of that evidence.²⁵ The complexities involved in deciding whether

¹⁹ *Id.* at 589-94.

²⁰ *Id.* at 591.

²¹ *Id.* at 592-94.

²² *Daubert*, 509 U.S. at 592-94.

²³ *Id.* at 597. *Daubert* sought to put to rest much of the ambiguity surrounding judges’ obligation under FRE 702 to decide upon the admissibility of scientific evidence. *Id.* at 589. However, more clearly delineating this responsibility did little to dispel the difficulty for judges in determining the relevance and reliability of such evidence. *Id.*

²⁴ Laura Stephens Khoshbin & Shahram Khoshbin, *Imaging the Mind, Minding the Image: An Historical Introduction to Brain Imaging and the Law*, 33 AM. J.L. & MED. 171, 184 (2007).

²⁵ *Id.* at 186. Juries have been shown to be heavily influenced by scientific testimony. In a study conducted by Deena Skolnick at Yale University, subjects were asked to judge the validity of explanations for various psychological phenomena, with some explanations being deliberately poor. *Id.* Subjects were generally accurate in spotting the bad explanations, except in instances where a few sentences of unrelated neuroscience were included. *Id.* at 183 (citing Paul Bloom, *Seduced by the Flickering Lights of the Brain*, SEED MAGAZINE, June

scientific evidence meets admissibility standards may be evinced in the courts' ongoing and tumultuous relationship with lie detection and brain scan evidence.

B. Admission of Lie Detection Evidence

Historically, brain scan evidence has proven very persuasive to juries in establishing the degree of responsibility of criminals.²⁶ At John Hinckley's trial for his assassination attempt on President Reagan in 1981, the court allowed the presentation to the jury of computerized axial tomography (CT) scans of Hinckley's brain, as well as the testimony of a psychiatrist who noted the presence of cerebral atrophy.²⁷ Despite the lack of scientific evidence linking the atrophy to Hinckley's actions, as well as testimony by a radiologist that the abnormality present in the scans could not reasonably be relied upon as the root cause of those actions, the jury still found Hinckley not guilty by reason of insanity.²⁸

Beyond evidence of brain pathology that could absolve a defendant of responsibility for his crimes, there exists the possibility of using more advanced brain scanning technology to determine whether or not that defendant actually committed the crime in question.²⁹ However, the utilization of neuroimaging

27, 2006, at 2-3 (citing Deena Skolnick Weisberg et. al., *The Seductive Allure of Neuroscience Explanations*, 20 J. COGNITIVE NEUROSCI. 1 (2008)).

²⁶ Khoshbin & Khoshbin, *supra* note 24, at 182 (describing the influence on juries of the images of brain scans combined with the endorsement of a neuroscientist).

²⁷ Khoshbin & Khoshbin, *supra* note 24, at 184. The psychiatrist noted that this type of atrophy was present in one-third of schizophrenics analyzed in one study. To one with even the most basic knowledge of the scientific method, this evidence is obviously inconclusive. Even still, this extremely weak and erroneously introduced evidence was sufficient to overcome the prejudice that must have existed in members of the jury against the President's would-be assassin. This case is demonstrative of the potential blinding power.

Khoshbin & Khoshbin, *supra* note 24, at 184.

²⁸ Khoshbin & Khoshbin, *supra* note 24, at 184.

²⁹ See Henry T. Greely & Judy Illes, *Neuroscience-Based Lie Detection: The Urgent Need for Regulation*, 33 AM. J.L. & MED. 377, 387 (2007). See also Mark Pet-

techniques to enable lie detection presents certain problems, not the least of which being the dubious nature of the history of polygraph evidence in the United States.³⁰

1. Lie Detection by Polygraph

The judicial system's turbulent relationship with lie detection devices began with the *Frye* court.³¹ In addition to setting a standard for the admission of scientific evidence that remained predominant for seventy years, *Frye's* assessment of the first systolic blood pressure deception test also expressed a suspicion of lie detection devices that remains largely untouched today,³² despite vast improvements in the technology.³³

In 1996, in *United States v. Scheffer*,³⁴ the United States Court of Appeals for the Armed Services reversed the conviction by general court-martial of airman Edward Scheffer on the grounds that the exclusion of polygraph evidence by the military judge was a violation of his Sixth Amendment right to present a

tit, Jr., *FMRI and BF Meet FRE: Brain Imaging and the Federal Rules of Evidence*, 33 AM. J.L. & MED. 319, 338-39 (2007).

³⁰ See David Gallai, *Polygraph Evidence in Federal Courts: Should it be Admissible?*, 36 AM. CRIM. L. REV. 87, 101-02 (1999).

³¹ Greely & Illes, *supra* note 29, at 411.

³² All states but New Mexico have flatly rejected polygraph evidence on the grounds that it fails the test for the admission of scientific evidence. Greely & Illes, *supra* note 29, at 411. New Mexico allows the admission of polygraph evidence only under certain conditions. Greely & Illes, *supra* note 29, at 411. Federally, most courts have also continued to exclude polygraph evidence based upon FRE 702 and 403. Pettit, *supra* note 29, at 331.

³³ Today's polygraph machines include a variety of sensory instruments, including cardiographs, pneumographs, cardio-cuffs, and various electrodes that measure galvanic skin response. Gallai, *supra* note 30, at 90. Despite these improvements, polygraph technology is still not seen as reliable enough to warrant admissibility in courts, partly due to "[t]he inherent ambiguity of the physiological measures..." Pettit, *supra* note 29, at 328 (quoting NATIONAL RESEARCH COUNCIL, *THE POLYGRAPH AND LIE DETECTION* 213 (Nat'l Acads. Press, 2003)). Further, there is a substantial subjective component to polygraph testing as the scoring of the test is usually done by an examiner. Gallai, *supra* note 30 at 93.

³⁴ 523 U.S. 303 (1998) (citing *United States v. Scheffer*, 44 M.J. 442 (1996)).

defense.³⁵ Subsequently, however, the Supreme Court reversed the decision, holding that a *per se* exclusion of polygraph evidence did not violate the Sixth Amendment because such evidence is not in itself factual:

The raw results of a polygraph exam—the subject’s pulse, respiration, and perspiration rates—may be factual data, but these are not introduced at trial, and even if they were, they would not be “facts” about the alleged crime at hand. Rather, the evidence introduced is the expert opinion testimony of the polygrapher about whether the subject was truthful or deceptive in answering questions about the alleged crime. A *per se* rule excluding polygraph results therefore does not prevent an accused—just as it did not prevent [Scheffer] here—from introducing factual evidence or testimony about the crime itself³⁶

Following *Scheffer*, the issue of polygraph evidence admission was further addressed in *United States v. Waters*,³⁷ which involved a prosecution for aggravated sexual abuse of a child.³⁸ At trial, the defendant sought to admit the fact that he had passed a polygraph examination conducted by an agent of the Federal Bureau of Investigation.³⁹ Waters’ lawyer argued that, in refusing to allow a *Daubert* hearing regarding the admissibility of the evidence, the government was impeding his ability to do proper discovery.⁴⁰ However, the trial judge flatly denied the request and

³⁵ *Scheffer*, 523 U.S. at 307-08 (*Scheffer*, 44 M.J. 442). The military judge excluded the polygraph examination pursuant to Military Rule of Evidence 707, which explicitly barred polygraph evidence from court-martial proceedings. *Id.* at 303. See also Pettit, *supra* note 29, at 329.

³⁶ 523 U.S. at 317, n. 13 (1998). See Pettit, *supra* note 29, at 329.

³⁷ 194 F.3d 926 (8th Cir. 1999).

³⁸ *Id.* at 928.

³⁹ *Id.*

⁴⁰ *Id.* at 930. See also Pettit, *supra* note 29, at 331-32.

excluded the evidence under FRE 403,⁴¹ a result that the Eighth Circuit affirmed on appeal.⁴²

In recent years, the debate over the admission of lie detection evidence has reemerged due to vast improvements in brain imaging technology and the possibility of using such methods to obtain more accurate, objective, and quantitative results than through use of traditional polygraph machines.⁴³ Two methods being specifically cultivated for lie detection purposes are functional Magnetic Resonance Imaging (fMRI)⁴⁴ and “Brain Fingerprinting” (BF).⁴⁵

⁴¹ FRE 403 states: “Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence.” FED. R. EVID. 403.

⁴² The appeals court held that it was unnecessary to address the rejection of the trial court to hold a *Daubert* hearing, as the court had “independently excluded the evidence under Fed. R. Evid. 403,” and thus any issues arising from FRE 702 that a *Daubert* hearing would have addressed, were moot. *See Waters*, 194 F.3d at 930. *See also* Pettit, *supra* note 29, at 332.

⁴³ *See* Pettit, *supra* note 29, at 323. *See also* Joseph H. Baskin et al., *Is a Picture Worth a Thousand Words? Neuroimaging in the Courtroom*, 33 AM. J.L. & MED. 239, 265-66 (2007).

⁴⁴ Images by standard MRI technology are created by introducing a strong magnetic field to the brain, which causes the nuclei of elements with odd numbers of protons to align. When a high-energy radio wave is then passed through them, this causes a signal that can be picked up by a receiver and converted into an image. fMRI combines this technique with blood oxygen level-dependent imaging (BOLD) to enable real-time detection of active brain areas. Active neurons convert oxyhemoglobin to deoxyhemoglobin as they use up oxygen, and these two molecules can be distinguished using MRI. Thus, the presence of deoxyhemoglobin indicates an oxygen-consuming (active) brain region, and the working theory behind fMRI is that lying takes more work (oxygen consumption) than telling the truth. Further, noting which brain areas are active can also offer insight into the truthfulness of a given response. *See* Khoshbin & Khoshbin, *supra* note 24, at 179-80; *see also* Pettit, *supra* note 29, at 320.

⁴⁵ BF uses electroencephalographic (EEG) sensors to detect neural impulses that result when a subject is exposed to various stimuli. Recording responses to a multitude of stimuli may enable a tester to distinguish between familiar and novel encounters, thus detecting whether the information in question is present or absent in the subject’s brain. Pettit, *supra* note 29, at 321. BF thus differs from other types of neuroimaging and the traditional polygraph in that

2. Lie Detection by Brain Scanning Techniques

Although the use of brain imaging for lie detection is a methodology still very much in its infancy, there are a few cases that have dealt with the admissibility of such evidence, all of which involving defendants seeking post-conviction relief based upon the results of BF examinations.⁴⁶ In 2000, Terry Harrington, convicted of first-degree murder in 1978, sought a new trial in an Iowa district court based upon newly discovered evidence, including the results of BF testing.⁴⁷ At trial, Dr. Farwell, the developer of the BF technique and the conductor of Harrington's BF examination, testified that Harrington's brain did not contain information about details of the murder, but did possess information that corroborated his alibi.⁴⁸ The district court judge denied relief on the basis that Harrington's claim was time barred, but on appeal the Supreme Court of Iowa reversed, and granted a new trial.⁴⁹ Although the new trial was granted on violation of due process grounds, and the BF evidence was thus not necessary to the result, this case marked the first instance such evidence had been admitted.⁵⁰

The case that has offered the most in-depth examination of the admissibility of BF evidence is *Slaughter v. State*,⁵¹ which has also served to highlight the shortcomings of the technology.⁵² As in *Harrington*, *Slaughter* had been convicted of first-degree murder and sought post-conviction relief based on the results of a BF test conducted by Dr. Farwell. Farwell stated in an

it actually tests the presence of information rather than detecting secondary responses resulting from lying about that information (e.g. increased heart rate, sweating, or excessive or localized brain activity). See Baskin et al., *supra* note 43, at 266.

⁴⁶ See Pettit, *supra* note 29, at 338-39.

⁴⁷ *Harrington v. State*, 659 N.W. 2d 509, 512 (Iowa 2003).

⁴⁸ *Id.* at 516, n. 6.

⁴⁹ *Id.* at 512-13.

⁵⁰ Pettit, *supra* note 29, at 338.

⁵¹ 108 P.3d 1052, 1052 (2005).

⁵² See Pettit, *supra* note 29, at 339 (noting the court's agreement with the State that "the salient details of the crime were presented at *Slaughter's* trial, thus casting doubt on the BF conclusion that these details were absent from *Slaughter's* brain.").

affidavit that the test showed that Slaughter's brain lacked knowledge about "salient details of the crime scene."⁵³ However, the court denied admission of this evidence on the grounds that there was insufficient proof that it could not have been brought in earlier appeals.⁵⁴ Dr. Farwell also failed to provide the court with a report on the nature of the test, including its accuracy.⁵⁵ Further, the court noted that the details of the murder purportedly absent from Slaughter's memory were presented at trial, a fact that raised significant doubt as to the accuracy of the test.⁵⁶

There are without a doubt, real and justifiable arguments against the admission of lie detection evidence. However, the skepticism that surrounds the technology, as a result of the judicial system's relationship with earlier versions of it, cannot be discounted. Any new artificial means of guilt-assessment must to some degree not only meet the standards of admission, but also prevail over the cynicism that has resulted from nearly a century of failing to meet those standards.

III. Complications

Independent of any judicial prejudice, the admission of brain scan evidence for lie detection purposes faces two primary challenges: passing the *Daubert* test, and overcoming the Fourth and Fifth Amendment rights to reasonable search and seizure and against self-incrimination.⁵⁷ Recent commentaries have suggested that compelling the accused to undergo a brain scan for the purpose of establishing guilt or innocence would be violative of these constitutional rights.⁵⁸ These rights, however, have

⁵³ Pettit, *supra* note 29 at 339 (quoting *Slaughter v. State*, 105 P.3d 832, 834 (Okla. Crim. App. 2005)).

⁵⁴ Pettit, *supra* note 29, at 339.

⁵⁵ Pettit, *supra* note 29, at 339.

⁵⁶ Pettit, *supra* note 29, at 339.

⁵⁷ See John G. New, *If You Could Read My Mind: Implications of Neurological Evidence for Twenty-First Century Criminal Jurisprudence*, 29 J. LEGAL MED. 179, 192-93 (2008).

⁵⁸ New, *supra* note 57, at 198. With respect to the Fifth Amendment right against self-incrimination, the important question is whether or not the information obtained from a brain scan test would be considered actual testimony

evolved into something more than was originally intended—the Fifth Amendment right from self-incrimination, for example, was incorporated to prevent obtaining confessions by torture.⁵⁹ Modernly, much of the force behind both the Fourth and Fifth Amendments has come from the Constitution’s unwritten right to privacy.⁶⁰ As brain scanning technology is physically non-invasive and painless, its coercive use would arguably not be contrary to the original thrust of the Fourth and Fifth Amendments, but would likely fail under the current interpretation.⁶¹ However, technologies that probe the thoughts and memories of an individual provide uniquely testimonial (blocked by Fifth Amendment) and physical (not blocked) evidence. As such, further delineation of the limits of these Amendments may ultimately be required.⁶²

With regards to the *Daubert* test, the current state of mind reading technology renders it inadmissible, as shown by the courts’ repeated rejection of such evidence.⁶³ However, once this technology advances to the point of passing through the *Daubert* gate, there must be some method of regulation or special treatment in place. Otherwise, the jury’s role may be completely usurped and the entirety of a trial could be conducted from the operating booth of an MRI suite. With that in mind, a helpful starting place is to examine the points at which the information that mind reading technology would provide either overlaps or intersects with the role the jury.

by that individual. New, *supra* note 57, at 193. Fourth Amendment issues become relevant in considering the extent to which submitting the accused to a brain scan test would invade their right to privacy and bodily integrity. New, *supra* note 57, at 196-97. See also Matthew Baptiste Holloway, *One Image, One Thousand Incriminating Words: Images of Brain Activity and the Privilege Against Self-Incrimination*, 27 TEMP. J. SCI. TECH. & ENVTL. L. 141, 154 (2008).

⁵⁹ New, *supra* note 57, at 194-95.

⁶⁰ New, *supra* note 57, at 195.

⁶¹ New, *supra* note 57, at 195.

⁶² Holloway, *supra* note 58, at 166 (discussing specifically information generated by BOLD fMRI).

⁶³ New, *supra* note 57, at 192 -93; see also discussion of *Harrington* and *Slaughter* at pp. 11-12, *infra*.

A. Factfinding

As noted above, studies have found that people are generally poor at detecting lies, reporting accuracy at around fifty percent, or at levels akin to chance.⁶⁴ Even by traditional polygraph methods, it is possible to achieve results that are far more accurate than the flipping of a coin.⁶⁵ So why then have we not relied on lie detection technologies more?

To begin with, artificially creating an adequate environment in a lab for testing lie detection is extremely difficult, as there are a multitude of variables that simply cannot be recreated with accuracy.⁶⁶ The stakes and underlying emotion of a trial, for instance, simply cannot be replicated.⁶⁷ Therefore, the accuracy of both artificial and human lie detection is difficult to measure with any reliability.⁶⁸

⁶⁴ Andrewartha, *supra* note 10 and accompanying text.

⁶⁵ See Gallai, *supra* note 30, at 98-99. Estimates of polygraph reliability have been seen to “range from below fifty percent to over ninety percent and that none of these estimates are free from methodological difficulties.” Gallai, *supra* note 30, at n.61 (quoting Yigal Bander, *United States v. Posado: The Fifth Circuit Applies Dauber to Polygraph Evidence*, 57 LA. L. REV. 691, 705 (1997)). One of the main problems with obtaining consistent polygraph results is the number of variables that are present during a given examination, including: the skill of the examiner, the health of the subject, the thoroughness of the pre-interview, and the environment in which the exam takes place. Gallai, *supra* note 30, at 98-99. The polygraph examination procedure also lacks certain minimum standards, which is likely further evidence of its subjective nature. The scoring of polygraph exams has been likened to “an interpretive art form.” Gallai, *supra* note 30, at 98 (quoting John C. Canham, Jr., *Military Rule of Evidence 707: A Bright Line Rule that Needs to be Dimmed*, 140 MIL. L. REV. 65, 69 (1993)).

⁶⁶ See Gallai, *supra* note 30, at 94-99.

⁶⁷ See Gallai, *supra* note 30, at 94-99. Other variables include: the subject actively rationalizing his answers or convincing himself of the truth of his responses, or his inability to recollect the incident in question. Gallai, *supra* note 30, at 95. Methods that rely solely on physiological responses, such as the polygraph, are thought to be affected by an even wider variety of variables, including, but not limited to: artifact physiological responses caused by the testing itself, purposeful self-inflicted pain by the subject during testing, cultural background, race, intelligence, and gender. Gallai, *supra* note 30, at 94-97.

⁶⁸ See Gallai, *supra* note 30, at 94-99.

Even with a highly accurate artificial means of detecting deception, there are other reasons why we would still choose to rely on the abilities of a jury rather than of a more reliable, yet still imperfect, machine.⁶⁹ The jury system enables society at large to be involved in the determination of guilt, and when mistakes are made, either by exonerating a guilty defendant or imprisoning an innocent one, society shares in the responsibility for this mistake.⁷⁰ Were a machine solely relied upon to assess guilt, one could imagine society as a whole quickly becoming distrustful of the judicial system if it came to light that the machine had erred.⁷¹ Human fallibility, on the other hand, is a given, and the mistakes of juries must on some level be begrudgingly accepted, as any one of us could have come to the same incorrect conclusion given the same evidence.

B. Responsibility

Another question that arises with the introduction of brain-based evidence is how that evidence might influence the jury's—and society-at-large's—view on the responsibility of the accused for the commission of his crimes.⁷² Regardless of the true nature of the mind, be it dualistic or purely material, society could end up viewing crime not as the result of conscious volitional action, but rather as the result of an abnormal brain.⁷³ Neuroscientist Wolf Singer's position is that commission of a

⁶⁹ See McClung, *infra* note 80, at 37 (discussing importance of juries in preserving “the civil rights of the people and the ever increasingly complex government, as well as the commercial and scientific world.”).

⁷⁰ Cf. Alschuler & Deiss, *infra* note 82, at 927 (Tocqueville described the jury as “a form of sovereignty of the people and a school in which citizens learn their rights.”).

⁷¹ Alschuler & Deiss, *infra* note 82, at 927.

⁷² See generally Henry T. Greely, *Neuroscience and Criminal Justice: Not Responsibility but Treatment*, 56 U. KAN. L. REV. 1103 (2008). In relying on the accused's brain to assess guilt, we would necessarily have to consider more deeply the underlying physical reasons for socially unacceptable behavior. *Id.* In so doing, we would in a way be removing some responsibility from the accused and shifting it to the accused's brain. *Id.*

⁷³ See David M. Eagleman, *Neuroscience and the Law*, 45-APR HOUS. LAW. 36, 38 (2008).

crime is in itself evidence of a brain abnormality.⁷⁴ Whether or not this extreme view has any bite, introduction of evidence of brain damage could prove perplexing to a legal regime based upon reliance on mind-reading devices: “[t]housands of natural experiments with brain tumors, degenerative disorders, drug addictions and traumatic brain injury illustrate a fundamental principle: when the brain is physically changed, the person is mentally changed.”⁷⁵

C. Constitutional Issues

The constitutional issues raised by mind reading technology are largely beyond the scope of this article, as the main focus is on the interaction this technology would have with the jury. Although discussion of Fourth and Fifth Amendment concerns will be limited to what has already been touched on above, two Constitution-related points inclusive of the jury bear mentioning before moving on. First, part of the jury’s job is to act as a check on the judicial system, and, subsequently, it serves as a means of protecting an accused’s constitutional rights.⁷⁶ Second, it is important to be aware of how of new technology influences constitutional considerations, either by making previous worries over constitutional violations moot, or by allowing maneuvering around a given constitutional protection.⁷⁷

⁷⁴ *Id.* at 38.

⁷⁵ *Id.* at 37. Dr. Eagleman poses a number of questions given this connection between mind and brain, including whether or not brain injury provides a legitimate basis for mitigation of sentencing, as well as the rationale of ascribing guilt to an individual when “most behaviors are driven by unconscious systems of the brain.” *Id.*

⁷⁶ *Cf.* McClung, *infra* note 80 at 35 (discussing Framers’ intention for jury to be charged with ensuring constitutional rights afforded to those at trial).

⁷⁷ *Cf.* Pardo, *infra* note 100, at 321. What constitutes a violation of an individual’s constitutional rights can become more precisely delineated (and perhaps manipulated) as technology advances. Examples of this include listening devices placed on the exterior of phone booths and thermal-imaging devices that allow one to view the inside of houses, both of which side-step Fourth Amendment violations of physical trespass. Pardo, *infra* note 100, at 321.

IV. Analysis

The utilization of mind reading technologies for guilt assessment is likely inevitable, and Michael Gazzaniga, Director of the Law and Neuroscience Project,⁷⁸ further predicts that neuroscience will eventually “dominate the entire legal system.”⁷⁹ Assuming that it will improve to the point where it would pass the *Daubert* test, I will analyze the pros and cons of adopting this technology with respect to the role of the jury as well as to our perceptions of personal responsibility.

A. Accuracy of Verdicts vs. Role of the Jury

The jury has existed in a variety of forms since its adoption in ancient Greece and Rome, with the reasons for its implementation varying as well.⁸⁰ The jury today holds two key roles: (1) deciding the facts of a given case and granting the accused a fair trial by his peers; and (2) serving as a check on possible corruption of the court system while adding credibility to a given verdict.⁸¹

⁷⁸ The Law and Neuroscience Project, funded by the John D. and Catherine T. MacArthur Foundation, is a cross-disciplinary venture with the purpose of utilizing neuroscience to create a better-functioning legal system and neuroscience infrastructure. The Law & Neuroscience Project, <http://www.lawandneuroscienceproject.org>, archived at <http://www.webcitation.org/5kqPUvrU7>.

⁷⁹ O. Carter Snead, *Neuroimaging and the “Complexity” of Capital Punishment*, 82 N.Y.U. L. REV. 1265, 1268 (2007) (quoting Michael S. Gazzaniga, *THE ETHICAL BRAIN* 88 (2005)).

⁸⁰ Megan Healy McClung, *A Brief History of the Jury*, 19-MAR CBA REC. 35, 35-36 (2005). The driving force behind Roman adoption of a jury system was a belief in the right of an accused to confront his accuser and defend himself, although in ancient Rome the “jury” was typically the mob that the accused would be tossed to should he fail to prove his innocence. *See id.* at 35. Athens on the other hand viewed the use of juries as a means to avoid corruption, with some juries being comprised of as many as 6,000 individuals. *Id.* at 35-36.

⁸¹ *See id.* at 37.

1. Fact Finding & Right to a Fair Trial

Regardless of whatever secondary roles the jury plays in the courtroom and in society at large, the ultimate responsibility of jurors is to determine the guilt or innocence of the accused.⁸² To this end, jurors must use their powers of perception to parse truth from untruth in witness testimony, which, as previously noted, is an ability that studies suggest we are not overtly adept at.⁸³ However, while there is certainly empirical evidence that people are not very reliable lie detectors,⁸⁴ that is not the whole story. Not only is it incredibly difficult to replicate the factors that are present in a courtroom situation in a lab setting,⁸⁵ but the job of a juror is not merely to assess whether or not a witness is telling the truth, but also to weigh other scientific and forensic evidence as well. This can include, among other things: phone and computer records, medical records, computer simulations, and DNA.⁸⁶ Thus, detecting the truth, or lack thereof, in a witness's statements is only a piece of the puzzle.⁸⁷

Our legal system, however, has long recognized the shortcomings of jurors' analytic abilities. The standard the jury is held to in rendering a verdict is "beyond a reasonable doubt," not absolute truth.⁸⁸ Medieval courts in effect attempted to circumvent this problem through interrogation of the accused, the only person who truly knew whether or not he had committed the

⁸² See Albert W. Alschuler & Andrew G. Deiss, *A Brief History of the Criminal Jury in the United States*, 61 U. CHI. L. REV. 867, 907 (1994) (quoting Chief Justice Marshall's charge to the jury in Aaron Burr's treason trial).

⁸³ See McClung *supra* note 80 (stating no one can accurately predict future while examining the history of the jury system).

⁸⁴ See discussion *supra* note 10 and accompanying text.

⁸⁵ See Gallai, *supra* note 67 and accompanying text.

⁸⁶ See Singer et al., *supra* note 13, at 90-98.

⁸⁷ Cf. Singer, *supra* note 13 (noting jury's purpose in examining all forms of evidence).

⁸⁸ See Simon A. Cole & Rachel Dioso-Villa, *CSI and its Effects: Media, Juries, and the Burden of Proof*, 41 NEW ENG. L. REV. 435, 466 (2007). Despite the fact that the modern view is that science itself does not produce absolute truths due to probability theory, whether or not a given defendant committed the crime in question does have an absolute answer (absent any metaphysical meanderings of course). *Id.*

crime.⁸⁹ Of course, there are inherent limitations to the accuracy of a confession given by someone whose arm is being submerged in boiling oil.⁹⁰

Although such barbaric means of obtaining confessions were largely abandoned by 1215,⁹¹ one could argue that a more subdued form of forcing confessions exists today, fueled not by fanaticism, but by expediency. As of 1994, ninety-three percent of those convicted of felonies in state courts have pled guilty, with an even higher percentage of guilty pleas reported in misdemeanor cases.⁹² Moreover, of those who were convicted at trial, nearly fifty percent of those convictions were handed down during bench trials.⁹³ Thus, for many accused, facing a plea-bargained commuted sentence versus spending a year or more awaiting trial in county jail only to be represented by an overworked public defender is a metaphorical vat of boiling oil. Indeed, “[p]rolonged, privacy-invading jury selection procedures, cumbersome rules of evidence, the repetitive cross-examination of witnesses, courtroom battles of experts, jury instructions that all the studies tell us jurors do not understand, and more, have made trials inaccessible for all but a small minority of defendants.”⁹⁴ This begs the question: if the ideals sought to be upheld by jury trials are primarily only maintained in spirit and not in practice, would defendants be better served by the utilization of scientific (i.e. brain scan evidence) alone?

⁸⁹ See McClung, *supra* note 80, at 36.

⁹⁰ See McClung, *supra* note 80, at 36.

⁹¹ Kadoch, *supra* note 4, at n.115 and accompanying text.

⁹² Albert W. Alschuler & Andrew G. Deiss, *A Brief History of the Criminal Jury in the United States*, 61 U. CHI. L. REV. 867, 922 (1994) (citing Richard Solari, *National Judicial Reporting Program*, 1988 47, Table 4.2a) (U.S. Dept. of Justice, Bureau of Justice Statistics, 1992)). There has historically been intense public disapproval in the U.S., and it was not until 1970 that the Supreme Court held plea-bargained waivers of a trial by jury to be constitutional. *Id.* at 924-25.

⁹³ Alschuler & Deiss, *supra* note 92, at 922.

⁹⁴ Alschuler & Deiss, *supra* note 92, at 926. The authors further note that because of these burdensome conditions, “American criminal procedure has become an administrative process rather than the adjudicative process it once was.” Alschuler & Deiss, *supra* note 92, at 925.

In addition to the infrequency of jury trials, there is significant evidence that the judicial system fails to obtain the correct result, not just by false confession, but also by the presentation of flawed evidence.⁹⁵ Professor Garrett of the University of Virginia School of Law conducted a study in 2007 examining 200 cases of exoneration by DNA evidence—innocents who spent an average of twelve years in prison and whom the justice system obviously failed.⁹⁶ Peter Neufield, a founder of the Innocence Project at Cardozo Law School further points out that “DNA testing is available in fewer than ten percent of violent crimes.”⁹⁷ This leads one to wonder how many other individuals are serving sentences for crimes they did not commit and for which they have little hope of being exonerated.

Garrett notes that the primary cause of wrongful conviction stems from eyewitness misidentification, which was present in seventy-nine percent of the cases.⁹⁸ The second most frequent error came from either faulty forensic evidence or forensic evidence that was given far too much weight at trial, such as the accused having the same blood type as blood found at the scene of the crime.⁹⁹ The latter is precisely what worries many about the application of neuroscience technologies to assess whether a suspect is telling the truth—the layperson simply does not understand enough about science to be able to ascribe the proper amount of weight to a given piece scientific evidence.¹⁰⁰

⁹⁵ Brandon L. Garrett, *Judging Innocence*, 108 COLUM. L. REV. 55, 55 (2008).

⁹⁶ *Id.* at 119. Garrett’s study highlighted that not only does our judicial system frequently fail to properly review evidence that is ultimately found to be unreliable, but that the majority of convicts seeking postconviction relief through DNA testing have difficulty acquiring access to that testing. As an article in the International Herald Tribune addressing Garrett’s study pointed out, the justice system has done little to alter its practices or be more sympathetic to potential exonerees in the wake of failures that DNA evidence has brought to light. Adam Liptak, *DNA exonerations highlight flaws in U.S. justice system*, INT’L HERALD TRIB., July 22, 2007, archived at <http://www.webcitation.org/5exjCzg1>.

⁹⁷ Liptak, *supra* note 96.

⁹⁸ Liptak, *supra* note 96.

⁹⁹ Liptak, *supra* note 96.

¹⁰⁰ See Michael S. Pardo, *Neuroscience Evidence, Legal Culture, and Criminal Procedure*, 33 AM. J. CRIM. L. 301, 301 (2006). Justice Thomas vocalized this

There is also the argument, however, that neuroscience evidence, even if highly accurate, would not interfere any more than DNA evidence with the jury's role in assessing innocence and guilt.¹⁰¹ However, DNA evidence, when properly applied, can identify the suspect with virtual certainty, and when coupled with other types of evidence, can alone meet the standard required for conviction.¹⁰² Likewise, if brain scan tests reach a certain level of accuracy, room for deliberation by the jury would necessarily be quashed.¹⁰³

It is important, however, to make a distinction between the judicial effect of DNA and brain scans. DNA only provides secondary evidence—it can show that the accused was present at the scene of the crime and thus make it more likely, in varying degrees depending upon the circumstances in which the evidence was found, that the accused committed the crime.¹⁰⁴ DNA still requires an inferential leap to be made, i.e. the suspect was

fear in *U.S. v. Scheffer*, stating that when presented with scientific evidence or the opinion of an expert witness, jurors may simply, through lack of understanding, "abandon their duty to assess credibility and guilt." 523 U.S. at 312-14.

¹⁰¹ Pardo, *supra* note 100, at 317-318. A neuroscience-based test does not directly determine whether or not a subject is telling the truth or has intimate knowledge of a crime, but rather looks at the brain responses of a subject. Although there is unquestionably far less wiggle room than that provided by the purely somatic responses targeted by polygraph, some might argue that there is still space for a jury to assess its accuracy. *See supra* note 33 and accompanying text.

¹⁰² Singer et al., *supra* note 13, at 96-98. The flipside to this is the so-called "CSI effect," in which the popular television show "CSI: Crime Scene Investigation" has placed a false sense of certainty of scientific evidence in the public. Singer et al., *supra* note 13, at 113-15. Prosecutors now worry that jurors want "100 percent proof" before rendering a conviction. Singer et al., *supra* note 13, at 113-15.

¹⁰³ *See* Pardo, *supra* note 100, at 318. Where evidence is so strongly in favor of a certain result that the facts are no longer in dispute and the jury could not rationally provide any other verdict than the one that the evidence points to, the judge may render a judgment as a matter of law, effectively acknowledging that the jury's role as factfinder in that case is superfluous because there are no facts to be decided. *See* Randi Ellias, *Should Courts Instruct Juries as to the Consequences to a Defendant of a "Not Guilty by Reason of Insanity" Verdict?*, 85 J. CRIM. L. & CRIMINOLOGY 1062, 1063 (1995).

¹⁰⁴ *See* Singer et al., *supra* note 13, at 98.

present at the crime scene and therefore committed the crime.¹⁰⁵ Brain scan evidence on the other hand, is more direct—where a brain-fingerprinting-type test shows presence of intimate knowledge of the crime scene that only the perpetrator could know, the inferential leap that is required is much less. Further, in the case of brain-image-based lie detection, there could no room for inference at all if the subject were asked directly whether or not he committed the crime.

2. Societal Acceptance & Against Corruption

Thomas Jefferson once remarked that the jury system is “the only anchor yet imagined by man by which a government can be held to the principles of its constitution.”¹⁰⁶ By allowing citizens to participate in trials, the jury system serves as a check on judges to prevent them from wielding their power indiscriminately and promotes acceptance of verdicts by the general public.¹⁰⁷ The use of a jury as a means of achieving a fair trial is not a new one—in ancient Athens the jury’s primary purpose was ensuring that judicial proceedings were not corrupted.¹⁰⁸

There are deep-seated feelings of suspicion in this country with respect to all branches of the government;¹⁰⁹ a mistrust likely rooted in our history of British oppression. Following the Revolutionary War, the populous generally felt that the legal system was unnecessary and that disputes could be resolved through people “applying common sense notions of right and wrong.”¹¹⁰ Among the difficulties associated with this proposition, and perhaps the reason for the sentiment in the first place, is that the law is complicated and not easily understood or applied by those who

¹⁰⁵ See Singer et al., *supra* note 13, at 97-98.

¹⁰⁶ McClung, *supra* note 80, at 35.

¹⁰⁷ See McClung, *supra* note 80, at 35.

¹⁰⁸ McClung, *supra* note 80, at 35-36.

¹⁰⁹ See Alschuler & Deiss, *supra* note 82, at 906.

¹¹⁰ Alschuler & Deiss, *supra* note 82, at 906.

have not engaged in intensive study of it; even then, the gray areas are many.¹¹¹

Dividing the responsibilities of finding facts and applying the law to those facts allows for societal involvement, a check on judicial power, and for societal acceptance of a verdict.¹¹² The more we detract from the jury's role as factfinder, the greater the chance for societal backlash and loss of faith in the judicial system, and the more we open the system up to possible corruption.¹¹³ On the flipside, if neuroscience evidence allows for more accurate verdicts, that in itself could go a long way towards combating the negative effects of relying on such evidence—provided of course that it could overcome any societal skepticism and fear of Orwellian intervention.

B. Accuracy vs. Loss of Individual Responsibility

In the future, neuroimaging techniques may bring our thoughts into a tangible form to be read and interpreted by others.¹¹⁴ With using this technology to determine guilt or innocence comes the philosophical question: if our minds are indeed anchored in the material world, how can we have free will and thus be truly be responsible for our actions, which by default are then combinatory products of our genetics and environmental influence? Moreover, if we do not have free will due to the exis-

¹¹¹ Cf. Alschuler & Deiss, *supra* note 82, at 906. Other difficulties include lack of process, questions of who would decide what is right or wrong, and ease of manipulation of such a system by opportunists.

¹¹² See Ellias, *supra* note 103, at 1063-64.

¹¹³ See Pardo, *supra* note 100, at 318 (noting the possibility for perjury by the technician conducting and/or evaluating brain scans).

¹¹⁴ *Japanese Dream Recording Machine*, NEW TANG DYNASTY TELEVISION, Apr. 1, 2009, archived at <http://www.webcitation.org/5ftM5DZyk>. This future may not be far away. Researchers in Kyoto, Japan have developed a technique that has been used to pull images directly from a subject's brain using MRI scans of the visual cortex. Subjects were shown hundreds of grey-scale images while being scanned by MRI, and the results were compiled into a computer program. When a subject then imagined one of the images, the program was able to reconstruct that image based upon concurrent MRI results. *Id.*

tence of some type of neurodeterminism,¹¹⁵ how can we justify punishing individuals for actions that they have no control over?

There are a variety of opinions regarding whether or not the existence of free will is even a requirement in the judicial process as well as what the implications actually would be of viewing the mind as a purely physical construct. In this section I will explore the free will requirement and the philosophical implications raised by neurodeterminism, as well as the pros and cons of neuroscience-based behavior prediction.

1. Free Will as a Sentencing Requirement

In sentencing someone for a crime they committed, we would like to think that we are punishing them for making a morally incorrect decision.¹¹⁶ Indeed, “[f]ree will and human agency are considered foundational for ascriptions of criminal responsibility in Anglo-American jurisprudence.”¹¹⁷ As Justice Jackson put it in *Morissette v. United States*:¹¹⁸

The contention that an injury can amount to a crime only when inflicted by intention is no pro-

¹¹⁵ Neurodeterminism, or neurophysical determinism, is the idea that our minds are not only wholly contained within our brains, but that the perception of conscious choice is an illusion because our brains merely react to stimuli, rendering out actions, as filtered through our mental machinery, inevitable. See Morse, *infra* note 116, at 2. This theory has been bolstered by recent studies, such as the one lead by John-Dylan Haynes, a neuroscientist at the Bernstein Center for Computational Neuroscience in Berlin. Ewen Callaway, *Brain Scanner Predicts Your Future Moves*, NEW SCIENTIST, Apr. 13, 2008, archived at <http://www.webcitation.org/5kfpmyVh>. In this study, subjects, while being observed through fMRI, were told to press a button with either their left or right hand whenever they felt the urge. *Id.* Researchers were not only able to observe a half-second lag between a subject deciding which hand to use and carrying out that action, but also to decipher brain signals in the prefrontal cortex that betrayed the subject’s decision on average seven seconds before they acted. *Id.*

¹¹⁶ See Stephen J. Morse, *Determinism and the Death of Folk Psychology: Two Challenges to Responsibility from Neuroscience*, 9 MINN. J. L. SCI. & TECH. 1, 1 (2008).

¹¹⁷ *Id.* at 1.

¹¹⁸ 342 U.S. 246, 246 (1952).

vincial or transient notion. It is as universal and persistent in mature systems of law as belief in freedom of the human will and a consequent ability and duty of the normal individual to choose between good and evil. A relation between some mental element and punishment for a harmful act is almost as instinctive as the child's familiar exculpatory 'But I didn't mean to'¹¹⁹

Traditionally, the law's view, via the "folk-psychological" model, is that people are free agents who are able to make rational decisions based upon their beliefs and desires, and are not mere "mechanical forces of nature."¹²⁰ Necessarily then, in the view of the law, legal mandates of behavior should actually shape it—even if one is not able to recognize that a given behavior is morally wrong or socially unacceptable, the undesirable consequences should he do what is unlawful should give pause.¹²¹

On the other hand, free will as more than an inherent belief is not ultimately required by our legal system—strictly speaking, the commission of a crime only requires that the agent acts with intention and the requisite mental state.¹²² An act that is committed with irrational thought is still deemed to have satisfied the intention requirement.¹²³ As long as the mens rea and actus reus prerequisites are met, the agent is held to be criminally responsible unless an excusing condition, such as insanity, exists.¹²⁴

Under the Model Penal Code (MPC),¹²⁵ in order for a defendant to be found legally insane, he "must have been suffering

¹¹⁹ *Id.* at 250-51.

¹²⁰ Morse, *supra* note 116, at 4.

¹²¹ See Morse, *supra* note 116, at 5-7.

¹²² See Morse, *supra* note 116, at 10 (ignoring strict liability crimes).

¹²³ See Morse, *supra* note 116, at 10.

¹²⁴ Morse, *supra* note 116, at 10.

¹²⁵ MODEL PENAL CODE § 4.01 (2001). The Code provides: "A person is not responsible for criminal conduct if at the time of such conduct as a result of mental disease or defect he lacks substantial capacity either to appreciate the cri-

from a mental disorder and, as a result, lacked substantial capacity to appreciate the criminality of his action or to conform his action to the requirements of the law.”¹²⁶ In other words, the defendant need not demonstrate that he lacked free will, only that he was unable to conceive of the unacceptable nature of his actions.¹²⁷ The legally relevant question then instead becomes whether intention itself exists—for how can one intend to do something when he ultimately is not an agent of free will but of a combination of biological and environmental circumstances?¹²⁸ We cannot, at our level of scientific understanding, simply “ignore what neuroscience tells us about the causal role of brain dysfunction in criminal behavior.”¹²⁹

2. Behavior Prediction

While the presence of a neurological defect can be used as a means of showing why a defendant should not be held accountable for his actions, the contrary position is that such a defendant should be punished more harshly because his condition predisposes him to reoffending.¹³⁰ Of course, this type of thinking seems prone to lead us down a slippery slope towards the argument for endorsement of negative eugenics that ended with the famous Supreme Court case of *Buck v. Bell*.¹³¹ The case addressed laws that directed the sterilization of “feeble-minded”

minality [wrongfulness] of his conduct or to conform his conduct to the requirements of law.” *Id.* at § 4.01(1).

¹²⁶ Morse, *supra* note 116, at 11.

¹²⁷ Morse, *supra* note 116, at 11-12.

¹²⁸ Morse, *supra* note 116, at 16 n.35 (questioning whether as a result “our responsibility practices are morally unjustified according to any moral theory we currently embrace.”).

¹²⁹ Richard E. Redding, *The Brain-Disordered Defendant: Neuroscience and Legal Insanity in the Twenty-First Century*, 56 AM. U.L. REV. 51, 118 (2006).

¹³⁰ Brent Garland & Mark S. Frankel, *Considering Convergence: A Policy Dialogue About Behavioral Genetics, Neuroscience, and Law*, 69-SPG LAW & CONTEMP. PROBS. 101, 104-06 (2006). Professor Adrian Raine, of the University of Pennsylvania, showed through PET scanning that men with antisocial personality disorder had an average of eleven percent less gray matter in their frontal lobes, the portion of the brain that is responsible for proper social judgment and impulse control. Redding, *supra* note 129, at 59-62.

¹³¹ 274 U.S. 200, 200 (1927).

individuals, with the intent, at least in part, of putting an end to “inherited criminality.”¹³²

Where a neurological defect is the root of criminal behavior, we should seek to intervene with treatment rather than use the presence of that defect as justification for increased punishment.¹³³ The most dramatic and clear-cut evidence of the effectiveness of proper treatment on the behavior of criminally-disposed individuals can be found in cases of brain tumors.¹³⁴ A compelling anecdote is the case of a forty-year-old man who had a clean criminal record, a stable marriage, and no previous sexually deviant inclination, who suddenly found himself sexually attracted to children.¹³⁵ He began incessantly seeking out child pornography and was eventually removed from his home by police when he was caught making advances toward his stepdaughter.¹³⁶ Subsequently, he was sent to a rehabilitation program for sexual offenders but was kicked out for consistently propositioning the nurses.¹³⁷ The day prior to being sentenced to jail time for not completing the rehabilitation program, the man entered the University of Virginia Hospital in Charlottesville and stated that he could no longer control himself and was going to rape his landlady.¹³⁸ Despite their skepticism given the status of his court case, doctors conducted an MRI and were stunned to find an egg-sized tumor pressing against the prefrontal lobe of his brain.¹³⁹

¹³² *Id.* Justice Holmes drafted the Supreme Court’s opinion affirming the decision of the Supreme Court of Appeals of Virginia to allow Buck, a mentally impaired woman whose mother and child were also impaired, to be sterilized. *Id.* Holmes infamously wrote, “[t]hree generations of imbeciles are enough.” *Id.* at 207. See also Garland & Frankel, *supra* note 130, at 110.

¹³³ See Ellias, *supra* note 103.

¹³⁴ See Nicholas Thompson, *Breakthroughs in Neuroscience are Changing Our Understanding of Criminal Culpability. That Worries a Leading Neuroscientist—but it Shouldn’t Worry Lawyers or Judges*, 2006-FEB Legal Aff. 50, 51-52 (2006) (stating “a defect in the function of the man’s brain caused by his tumor seems to have been the cause of his criminal actions”).

¹³⁵ *Id.* at 50.

¹³⁶ *Id.*

¹³⁷ *Id.*

¹³⁸ Thompson, *supra* note 134, at 50.

¹³⁹ The prefrontal cortex plays an important role in self-restraint and morality. Thompson, *supra* note 134, at 50. Frontal Lobe Disorder is characterized by

Upon removal of the tumor, the man's personality and sense of morality returned—he completed the rehabilitation program and returned to his normal life.¹⁴⁰ Approximately a year following the surgery, his tumor reappeared, as did his deviance.¹⁴¹ Yet again the doctors removed the tumor and he was restored to his normal self.¹⁴²

Whether or not Wolf Singer's proposition that criminality itself presupposes an abnormal brain, an underlying neurological defect responsible for criminal behavior need not be as concretely anomalous as a brain tumor. The root of behavior can also be based in more subtle and less easily identifiable causes such as brain chemistry, genetics, or some combination thereof. Drug addicts, for example, have been shown to have markedly different brains from non-addicts, and it is becoming clear that there is a genetic predisposition towards addiction.¹⁴³ As we learn more about the interplay between brain and behavior, we will be better able to effectively treat criminality.¹⁴⁴

V. Conclusion

Guilt-assessment technologies that could be utilized by the judicial system to more accurately determine guilt are not yet advanced enough to allow for inclusion in trials or to endanger the jury's role. It is certain, however, that there will come a point in the future where they will, and it is important to address the various issues that will arise before this happens. These technologies not only have the potential to greatly increase the accuracy

impaired social judgment, lack of inhibition, and impulsiveness. Redding, *supra* note 129, at 59.

¹⁴⁰ Thompson, *supra* note 134, at 50.

¹⁴¹ Thompson, *supra* note 134, at 51.

¹⁴² Thompson, *supra* note 134, at 51.

¹⁴³ Garland & Frankel, *supra* note 130, at 104.

¹⁴⁴ Greely, *supra* note 72, at 1106. There are currently four methods by which we can cause brain changes that will alter behavior: drugs, vaccines, neurosurgery, and deep brain stimulation (DBS). Greely, *supra* note 72, at 1106-07. Applications of behavior-altering treatments are already visible in the chemical castration of certain sex offenders and court-ordered administration of anti-psychotic medications. Greely, *supra* note 72, at 1109.

of verdicts, but they will necessarily spur significant change to the way in which the legal system operates. The system itself will have to bend in order to accommodate these tests, for it is first and foremost the judicial system's duty to punish the guilty and absolve the innocent.

It is inevitable that the jury's role as fact-finder will diminish as a result of allowing neuroscience evidence, but there are other means by which we can fill the jury's secondary roles. To avoid corruption, we could implement a private agency to either administer or review tests in a double-blind manner where technicians examine the scans that correspond to question numbers, without having access to any information about the case or the questions. To maintain societal acceptance of verdicts, we could make sure that there is as much transparency as possible with the testing, and perhaps appoint societal representatives to oversee the tests or appoint members of the community to observe. Conceivably, the substance of appeals would be reasons why the testing could have produced erroneous results.

The philosophical ramifications that will extend from this technology, I would argue, are largely moot. The reason that we believe that we have free will is because that is our perception—and we must live in the world as we experience it to be. We must at least acknowledge, however, that the faculties with which we exert our individual wills are grounded, if not wholly contained, within the physical structure of our brains. As such, the physical filter through which our minds interact with the world can become diseased or impaired, just as any other part of our body. In assessing criminality in the future, we should utilize our knowledge of neuroscience to delineate actions that portray a need for treatment or punishment. Where we will draw that line, and how we will manage those with ascribed brain abnormalities in a manner that avoids a Soma-filled future, however, is the stuff of dialogues that need to happen now.