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PROBING THE MIND: NEUROSCIENCE, THE RULES OF EVIDENCE, AND THE CONSTITUTION

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When one mentions the word “neuroscience” to the ordinary citizen, it is likely to evoke awe, curiosity, fear of the Orwellian state, or perhaps a combination of all three. The technology behind the science is still in its infancy; as a result, the legal discussion has largely been an academic one, with limited instances of concrete success in incorporating neuroscience evidence into the American legal mainstream.

As use of the technology becomes more widespread, however, such use will invariably creep into our nation’s courtrooms. When it does, attorneys and judges alike will be forced to assess whether our current legal structure is equipped to handle the wellspring of issues associated with the admission of neuroscience evidence. These issues, while framed in the American context for this report, have already begun to arise in other national and international legal environments.

“Neurolaw,” or the intersection between neuroscience and its attendant legal issues, has the potential to reach almost all areas of the law—tort law, criminal procedure, contract law, et cetera. This paper will winnow its focus to three primary areas: (1) privacy for criminal suspects and defendants as guaranteed by the United States Constitution; (2) proportionality in sentencing; and (3) the rules of evidence.

THE INSTRUMENTS AT HAND: WHAT LIES BEHIND THE CURTAIN OF NEUROSCIENCE?

Before venturing forth with a discussion on the pertinent legal issues, some scientific background is necessary. While there are numerous ways by which brain scans could be introduced into the courtroom, this report will address two chief functions: (1) identification of cognitive function and (2) lie detection.

On the lie detection front, scholars have highlighted two promising techniques: electroencephalography (EEG) and functional magnetic resonance imaging (fMRI). An EEG study “measures electrical activity in the brain,” with “researchers plac[ing] electrodes on a subject’s skull to

detect, localize, and record electrical activity within the brain as a subject performs tasks.”¹ Of particular interest is the P300 wave, which is a “measurement of electrical activity . . . that results whenever a meaningful piece of information is rarely presented among a random series of more frequently presented, non-meaningful stimuli often of the same category as the meaningful stimulus.”² Put simply, it can reveal a subject’s familiarity with a particular piece of information, so long as the proper controls are in place. While the P300 does “not represent a lie per se,” the verbal denial of a familiar item of information would “imply deception.”³

The other major method of lie detection is use of the fMRI. An fMRI scan would “detect[] changes in hemodynamic (literally ‘blood movement’) properties of the brain as a subject engages in specific mental tasks.”⁴ Such an examination attempts to discern “which regions of the brain are working, how much, and for how long, during particular tasks.”⁵ The same technique of neuroimaging can be used to determine cognitive ability.⁶

As one can imagine, this technology is not without its faults; accordingly, admissibility of neuroscience evidence has been an uphill climb, especially in the federal courts. Naturally, a subject as complex as brain science must be accompanied by expert testimony in order to be admitted. While the states have varying standards for evidentiary admissions, the federal courts use what is referred to as the *Daubert* standard.⁷ *Daubert* requires trial courts to consider, with flexibility, the following factors as part of a non-exhaustive list: (1) the falsifiability, refutability, or testability of a theory; (2) peer-review or publication; (3) the known or potential rate of error; and (4) general acceptance in the scientific

¹ SHEN Francis X. & JONES, Owen D., 2011, p. 864, **Brain Scans as Evidence: Truth, Proofs, Lies, and Lessons**, *Mercer Law Review*.

² SHEN Francis X., 2013, p. 684, **Neuroscience, Mental Privacy, and the Law**, *Harvard Journal on Law and Public Policy*.

³ *Id.*

⁴ SHEN Francis X. & JONES, Owen D., 2011, p. 864, **Brain Scans as Evidence: Truth, Proofs, Lies, and Lessons**, *Mercer Law Review*.

⁵ *Id.*

⁶ LAMPARELLO Adam, 2011, p. 481, **Using Cognitive Neuroscience to Predict Future Dangerousness**, *Columbia Human Rights Law Review*; PERLIN Michael L., 2009, p. 885, **‘His Brain Has Been Mismanaged with Great Skill’: How Will Jurors Respond to Neuroimaging Testimony in Insanity Defense Cases?**, *Akron Law Review*.

⁷ **Daubert v. Merrell Dow Pharmaceuticals, Inc.** [1993] 509 U.S. 579.

community.⁸ While a “well-established” science can survive the *Daubert* inquiry with ease, the still-evolving field of neuroscience has a more difficult time of surviving this threshold test.

Consider *United States v. Semrau*,⁹ a decision by the U.S. Court of Appeals for the Sixth Circuit. There, a doctor on trial for healthcare fraud sought to introduce evidence of fMRI testing indicating that he was telling the truth when he claimed that he “attempted to follow proper billing practices in good faith.”¹⁰ The magistrate judge declared the evidence inadmissible for several reasons. First, there were “no known error rates for fMRI-based lie detection outside the laboratory setting, i.e., in the ‘real-world’ or ‘real-life’ setting.”¹¹ Second, the fMRI evidence was part of a “best two-out-of-three” analysis, with the first examination indicating that the defendant was deceptive.¹² Third, the evidence was “highly prejudicial,” serving only to bolster the defendant’s credibility.¹³ The appellate court agreed with the magistrate judge in all aspects of his analysis and affirmed his decision.

Semrau was one of the first cases to address the admissibility of fMRI testing for lie-detection purposes.¹⁴ It illustrates the challenges in getting neuroscience evidence even *admitted* into the courtroom, and does not discuss broader constitutional and evidentiary implications that arise upon passing the threshold of admissibility. The great flaw of the science is that “we still do not have sophisticated causal knowledge of how the brain works generally,” making the “scientific problems . . . fearsomely difficult.”¹⁵ This report does not endeavor to tackle the task of discerning where the science must go for neuroimaging to be admitted with regularity in American courtrooms; instead, it will proceed under the assumption that such evidence *is* admissible.

⁸ *Id.* at 593-95.

⁹ ***United States v. Semrau*** [2012] 693 F.3d 510 (6th Cir.).

¹⁰ *Id.* at 516.

¹¹ *Id.* at 521.

¹² *Id.* at 522-23.

¹³ *Id.* at 523.

¹⁴ *Id.* at 513.

¹⁵ MORSE Stephen J., 2013, p. 512, ***Brain Overclaim Redux***, *Law & Inequality: A Journal of Theory and Practice*.

BRAIN CELLS OR THOUGHTS? NEURO-PRIVACY AND THE ONGOING DEBATE OF CHARACTERIZATION

Neuroscience is likely to make its debut into the legal mainstream through criminal law, with the federal Constitution being the likely vehicle for such an introduction. Two constitutional provisions offer a host of safeguards for criminal suspects and defendants before they reach the courtroom. The Fourth Amendment guards against “unreasonable searches and seizures.” On an elementary level, the protection extends to persons, things, and places. Digging deeper, however, the Fourth Amendment is understood to *privacy*—but such privacy must be recognized by both the individual invoking the constitutional protection, as well as society at large.¹⁶

The Fifth Amendment, on the other hand, is a more personal right. It provides a litany of protections—chief among them, the right to due process. But it also commands that “[n]o person shall . . . be compelled in any criminal case to be a witness against himself.” This provision, known as the Self-Incrimination Clause, enshrines a criminal defendant’s right to silence.

Nevertheless, the privilege against self-incrimination is not an invincible one. In investigatory settings, defendants must be particular about *how* they invoke the right to silence; a lapse can compromise the invocation of the right.¹⁷ More importantly for our purposes, the right encompasses only “testimonial” statements—that is, statements relating to factual assertions or disclosures of information.¹⁸

The dichotomy of the Fourth and Fifth Amendments sets the scene for introducing the problem of classification. Technological advances in neuroscience have been achieved at a dazzling rate, but the development of our laws—and our Constitution—have not kept pace. The most difficult question is also the most rudimentary: how do we characterize neuroscience evidence used in the criminal context? Do we consider a probe of the mind a “search” of brain cells, as it merely captures how the brain looks in

¹⁶ **Katz v. United States** [1967] 389 U.S. 347, 361 (Harlan, J., concurring).

¹⁷ **Berghuis v. Thompkins** [2010] 130 S. Ct. 2250, 2260 (U.S.) (requiring suspects to explicitly invoke the right to remain silent).

¹⁸ **Pennsylvania v. Muniz** [1990] 496 U.S. 582, 589.

response to certain stimuli?¹⁹ Or does the picture tell us more? Does brain activity make a “statement” regarding criminal activities so as to render the evidence “testimonial?”

Much ink has been spilled in resolving this debate. This report will refrain from entering into the fray, but will merely provide a brief exposition on the current stalemate.

Those who advocate for a Fourth-Amendment approach treat brain scans in a manner similar to “blood tests, breathalyzer tests, and fingerprint tests.”²⁰ Since neuroscience information is ultimately derived from a suspect’s body, likening it to these physical tests is a “fairly straightforward” proposition for such proponents.²¹ In contrast, those who take the Fifth Amendment tack highlight the fact that neuroimaging is often drawn from scenarios in which brain responses are elicited by a direct line of questioning.²² Even if the suspect does not respond, the neuroimaging in itself may constitute “an incriminating response from the suspect,”²³ thereby rendering the brain responses “testimonial.” Scholars are currently adopting one stance or the other, taking both,²⁴ or taking neither—this is not a debate that will end in the near future.²⁵

But there is more to ponder—the next great question deals not with the suspect, but with others. Specifically, what is the extent that neuroscience evidence can be used to obtain search or arrest warrants? Assume, for a moment, that a person has consented to an EEG scan (or the police obtain a warrant). What can be done with information that is gleaned from it? Could law enforcement use heightened responses to meaningful stimuli (such as the P300 wave) as a basis for obtaining a warrant, even with the scanned subject’s silence?

¹⁹ SHEN Francis X., 2013, p. 699, **Neuroscience, Mental Privacy, and the Law**, *Harvard Journal on Law and Public Policy*.

²⁰ PARDO Michael, 2006, p. 321-22, **Neuroscience Evidence, Legal Culture, and Criminal Procedure**, *American Journal of Criminal Law*.

²¹ *Id.* at 325.

²² SHEN Francis X., 2013, p. 704, **Neuroscience, Mental Privacy, and the Law**, *Harvard Journal on Law and Public Policy*.

²³ **Rhode Island v. Innis** [1980] 446 U.S. 291, 301.

²⁴ SHEN Francis X., 2013, p. 702-03, **Neuroscience, Mental Privacy, and the Law**, *Harvard Journal on Law and Public Policy*.

²⁵ FARAHANY Nita, 2012, p. 366, **Incriminating Thoughts**, *Stanford Law Review* (“Neither ‘physical’ nor ‘testimonial’ accurately describes neurological evidence.”).

Under our Fourth Amendment jurisprudence, the answer is unclear. It lies, however, within the probable cause standard. The standard, which takes the totality of the circumstances into consideration, “deal[s] with probabilities . . . [and] the factual and practical considerations of everyday life on which reasonable and prudent men, not legal technicians, act.”²⁶ While neuroscience technology may never achieve perfection,²⁷ the probable-cause standard does not demand it; indeed, the more reliable the technology becomes, the more likely it could be used as a basis for obtaining a warrant.²⁸ It does not escape the imagination to think that a person’s home could be searched or a person could be arrested simply on brain-scan responses to familiar stimuli, even with the questioned subject’s silence.

If the debate over classification makes anything clear, it is that the current framework of criminal procedure law is sufficient to address the growing use of neuroscience in the criminal investigation context—at least, for a suspect who might be subject to a brain scan. But police investigators, prosecutors, and judges must be cautious when neuroimaging can be used to implicate others beyond the examinee.

THE EIGHTH AMENDMENT: RETHINKING BROADER STROKES FOR FINER POINTS

Protections for a defendant do not end with a finding of guilt at trial or a plea agreement with the Government. Federal trial judges, for instance, are tasked with balancing a host of considerations in crafting a sentence for a convicted defendant. Some, such as “the nature and circumstances of the offense” and “the need for the sentence imposed,” are statutorily imposed by Congress or state legislatures through provisions such as 18 U.S.C. § 3553(a).²⁹ Others, such as the procedural and substantive reasonableness of a sentence, are imposed as the result of a peculiar interplay between the Sentencing Guidelines and our caselaw.³⁰

One of the most prominent *constitutional* protections, however, lies within the Eighth Amendment. It provides that: “Excessive bail shall not be required, nor excessive fines imposed, nor

²⁶ **Illinois v. Gates** [1983] 462 U.S. 213, 230-31.

²⁷ GARLAND Brent et al., 2004, p. 113, Neuroscience and the Law.

²⁸ **Illinois v. Gates** [1983] 462 U.S. 213, 230.

²⁹ 18 U.S.C. § 3553 (2006); *id.* § 3582.

³⁰ E.g., **Gall v. United States** [2007] 552 U.S. 38.

cruel and unusual punishments inflicted.” The third provision, often referred to as the Cruel and Unusual Punishments Clause, has served as the focal point of several sentencing cases over the years, particularly the Supreme Court’s cases on capital punishment.

At first, the Supreme Court recognized that the Cruel and Unusual Punishments Clause demanded “[c]onsideration of both the offender and the offense in order to arrive at a just and appropriate sentence”³¹—in other words, it compelled an individualized approach to determining proportionality in sentencing. But at the start of the new century, the Court has trended towards sweeping, categorical approaches to determining whether a sentence was proportionate for a class of offenders.³² Neuroscience evidence played a distinct role in some of these cases. The technology behind such evidence is becoming better understood and more widely available—as that happens, it may usher a call for a rethinking and revisiting of the Court’s decisions.

But first, some background. The contemporary shift to a categorical approach began with the Supreme Court’s 2002 decision in *Atkins v. Virginia*.³³ In *Atkins*, a mentally-disabled offender with an IQ of 59 was convicted of abduction and murder.³⁴ A jury twice sentenced him to die—the first sentence was nullified due to a procedural quirk.³⁵ On the first occasion, an expert testified that the offender was “mildly mentally retarded,” but on the second, another expert concluded that he was of “average intelligence, at least,” and not mentally disabled.³⁶

Citing a national consensus against the execution of the mentally disabled,³⁷ the Court concluded that “death is not a suitable punishment for a mentally retarded criminal.”³⁸ Moreover, from a penological standpoint, a mentally-disabled offender’s diminished capacity “to understand and process information, to

³¹ **Woodson v. North Carolina** [1976] 428 U.S. 280, 304.

³² TRIGILIO Joseph & CASADIO Tracy, 2011, p. 1387, **Executing Those Who Do Not Kill: A Categorical Approach to Proportional Sentencing**, *American Criminal Law Review*.

³³ **Atkins v. Virginia** [2002] 536 U.S. 304.

³⁴ *Id.* at 307.

³⁵ *Id.* at 308-09.

³⁶ *Id.*

³⁷ *Id.* at 316 (“The practice, therefore, has become truly unusual, and it is fair to say that a national consensus has developed against it.”).

³⁸ *Id.* at 321.

communicate, to abstract from mistakes and learn from experience, to engage in logical reasoning, to control impulses, and to understand the reactions of others” also diminished his personal culpability for a crime.³⁹ Such diminished culpability militated against the imposition of the gravest penalty of death for this class of offenders.⁴⁰

But *Atkins* was not a “categorical” decision in the purest sense. It spawned what is now known as “*Atkins* hearings,” which determine whether an offender is mentally disabled for Eighth Amendment purposes. As one can imagine, there are inconsistencies amongst the states as to how an *Atkins* determination is made.⁴¹

The Court did not render a true “categorical” decision until 2005. In *Roper v. Simmons*,⁴² it determined that the Cruel and Unusual Punishments Clause barred the imposition of the death penalty for juvenile offenders. As with *Atkins*, the Court looked to the development of a national consensus against a juvenile death penalty.⁴³ But it also pointed to “scientific and sociological studies . . . confirm[ing] ‘[a] lack of maturity and an underdeveloped sense of responsibility . . . found in youth . . . result[ing] in impetuous and ill-considered actions and decisions.’”⁴⁴ The Court observed that “the character of a juvenile is not as well formed as that of an adult,” and that juveniles were “more vulnerable or susceptible to negative influences and outside pressures.”⁴⁵

Relying upon these considerations, the Court arrived at the same conclusion as it did for mentally-disabled defendants in *Atkins*: juvenile defendants were less culpable, thus the death penalty was less befitting.⁴⁶ It recognized that some juvenile offenders were prone to be more mature than others and perhaps beyond redemption, but the Court nevertheless rejected an individualized approach to the juvenile

³⁹ *Id.* at 318.

⁴⁰ *Id.* at 319.

⁴¹ RAFFENSPERGER Kathryn, 2012, p. 739, **Atkins v. Virginia: The Need for Consistent Substantive and Procedural Application of the Ban on Executing the Intellectually Disabled**, *Denver University Law Review*.

⁴² **Roper v. Simmons** [2005] 543 U.S. 551.

⁴³ *Id.* at 555-56.

⁴⁴ *Id.* at 569.

⁴⁵ *Id.* at 569-70.

⁴⁶ *Id.* at 574.

death penalty.⁴⁷ A categorical ban, it reasoned, was necessary because even the most expert psychologists had difficulty differentiating between “the juvenile offender whose crime reflects unfortunate yet transient immaturity, and the rare juvenile offender whose crime reflects irreparable corruption.”⁴⁸

Further progress was made on the juvenile front in *Graham v. Florida*.⁴⁹ There, the Court extended *Roper*’s rationale to what the Court called “the second most severe penalty permitted by law”—life imprisonment without the possibility of parole.⁵⁰ The Court barred such sentences for juvenile offenders—but only for nonhomicide offenses.⁵¹ The question of whether the penalty applied to juveniles committing homicide offenses would not be answered until later.

Graham proved remarkable for several reasons. First, the Court’s concept of a “national consensus” expanded beyond *legislative* consensus—instead of looking only to the statutes enacted by a particular jurisdiction, the Court examined sentences meted out by the state courts. From this data, it determined that “only 11 jurisdictions nationwide . . . impose life without parole sentences on juvenile nonhomicide offenders . . . while 26 States, the District of Columbia, and the Federal Government do not impose them despite apparent statutory authorization.”⁵²

More remarkably for our purposes, the Court reinforced its observation in *Roper* that juveniles had diminished culpability. It was here that neuroscience made one of its first overt appearances in Eighth-Amendment caselaw: the Court commented that “developments in psychology and brain science continue to show fundamental differences between juvenile and adult minds.”⁵³ As part of this commentary, the Court credited an amicus brief by the American Medical Association in noting that “parts of the brain involved in behavior control continue to mature through late adolescence.”⁵⁴ This observation served as a springboard for a discussion on whether the four traditional penological goals

⁴⁷ *Id.* at 572.

⁴⁸ *Id.* at 573.

⁴⁹ ***Graham v. Florida*** [2010] 130 S. Ct. 2011 (U.S.).

⁵⁰ *Id.* at 2027.

⁵¹ *Id.* at 2024.

⁵² *Id.* at 2024.

⁵³ *Id.* at 2026.

⁵⁴ *Id.* at 2028.

(retribution, deterrence, incapacitation, and rehabilitation) were adequately served by allowing for life-without-parole sentences for nonhomicide juvenile offenders. The Court concluded that the four penological objectives weighed in favor of banning such inflexible sentences.

It was not until the Court's 2012 decision in *Miller v. Alabama*,⁵⁵ that it addressed juvenile homicide offenders. There, the Court reinforced its observations on the neurological and behavioral aspects of juvenile development; it went so far as to quote an amicus brief filed by the American Psychological Association which stated that "an ever-growing body of research in developmental psychology and neuroscience continues to confirm and strengthen the Court's conclusions [in *Graham*]."⁵⁶ But *Miller*'s reach was not as sweeping as *Graham*'s. Partly harking back to the individualized approach of *Woodson*, the Court held that mandatory life imprisonment sentences—i.e., cases where the trial judge possesses no discretion under the law to consider the circumstances of the offense and offender in imposing a life sentence without the possibility of parole—violated the Eighth Amendment.⁵⁷ Discretionary life-without-parole sentences, on the other hand, were another matter; as long as a sentencing judge "take[s] into account how children are different, and how those differences counsel against [an irrevocable life sentence]," such sentences were constitutionally satisfactory.⁵⁸ Over the dissent of four Justices, *Miller* marked the end of mandatory life-imprisonment-without-parole for *all* juveniles.

The anticipated growth in the use of neuroscience technology in criminal litigation, combined with the evolution of the Court's Eighth Amendment jurisprudence, raise a host of questions. First, if brain mapping can establish diminished capacity and culpability, should *Atkins* be extended to life-imprisonment cases as the natural "next step" of *Miller* and *Graham*, despite the latter cases' emphases on penological goals not implicated in *Atkins*?

⁵⁵ ***Miller v. Alabama*** [2012] 132 S. Ct. 2455 (U.S.).

⁵⁶ *Id.* at 2465 n.5.

⁵⁷ *Id.* at 2467-69.

⁵⁸ *Id.* at 2469.

Second, what role should neuroscience evidence have in cases involving term-of-years sentences for juveniles? Does the proportionality principle of the Eighth Amendment compel trial judges to examine neuroscience evidence in fashioning such sentences, with juvenile diminished capacity accounted for by a reduced sentence or an alternative means of serving a sentence? Or is it for Congress and the state legislatures to fashion an effective incorporation of neuroanalysis in the sentencing scheme?

Finally, what role should neuroscience evidence play in cases involving *adults*, particularly those who are not mentally disabled? While the categorical bans of the Eighth Amendment currently do not reach beyond capital punishment or life imprisonment, there is a growing movement to incorporate syndromes diagnosable by neuroimaging—such as Post-Traumatic Stress Disorder—into sentencing mitigation schemes.⁵⁹ Is there a need to revisit the sentencing laws to incorporate such evidence, or do provisions such as § 3553(a)'s “history and characteristics of the defendant” clause serve as adequate vehicles? To best answer these questions, legislators and sentencing courts alike should take steps to familiarize themselves with this emerging science.

THE RULES OF EVIDENCE: WITNESSES, TRUTH-TELLING, AND AVOIDING THE SPECTACLE OF MINI-TRIALS

The final component of this report will not address a constitutional issue, but an evidentiary one—how can neuroscience be used to establish, dismantle,⁶⁰ or rehabilitate a testifying witness's credibility? In the federal system, Rule 608 of the Federal Rules of Evidence serves as the gatekeeper for the admission of evidence concerning a witness's propensity for truthfulness. It provides:

A witness's credibility may be attacked or supported by testimony about the witness's reputation for having a character for truthfulness or untruthfulness, or by testimony in the form of an opinion about that character. But evidence of truthful character is admissible only after the witness's character for truthfulness has been attacked.

⁵⁹ GREY Betsy J., 2012, p. 53, **Neuroscience, PTSD, and Sentencing Mitigation**, *Cardozo Law Review*.

⁶⁰ There is a strong argument to be made that neuroscience evidence used to contradict a witness's statement is better suited for admission under Rule 607, which is the general rule for impeaching a witness's credibility. KECKLER Charles N.W., 2006, p. 545-46, **Cross-Examining the Brain: A Legal Analysis of Neural Imaging for Credibility Impeachment**, *Hastings Law Journal*.

To avoid the deleterious effect of “mini-trials,” i.e., extended inquiries into a witness’s truthful character,⁶¹ courts possess a great deal of discretion in allowing or disallowing such inquiries.⁶²

Given the increased potential for neuroscience technology to be used as a means of lie detection, it is not difficult to see how Rule 608 can serve as a hotbed for dispute. Jurors may be tempted to view neuroscience evidence as the “trump card” or “be all, end all,” especially if the caselaw on polygraph admissibility is any guide.

In the past, polygraph tests—often viewed as the precursor to modern neuroscience technology—could be used to restore witness credibility once it was challenged on cross-examination.⁶³ Complicating matters, however, was the Supreme Court’s decision in *United States v. Scheffer*.⁶⁴ There, an enlisted member of the U.S. Air Force was court-martialed on charges of using methamphetamine (among others).⁶⁵ To defend himself, the airman asked the military tribunal for permission to introduce polygraph evidence taken during the course of his assignment with a drug investigation unit.⁶⁶ The polygraph evidence would have indicated that the airman was being truthful when answering that he had not used drugs since joining the Air Force.⁶⁷ Citing a military evidentiary rule banning the admission of polygraph examination results, the military judge denied the airman’s request.⁶⁸

After contradicting results in the intermediate military courts of appeals, the matter reached the Supreme Court. The Court upheld the ban as reasonable, citing three chief concerns: (1) the lack of a scientific consensus as to the reliability of the polygraph; (2) the risk that the polygraph would usurp the

⁶¹ ***United States v. Williams*** [2006] 464 F.3d 443, 448 (3d Cir.).

⁶² Evidentiary decisions rendered under Rule 608(b) are subject to review under an “abuse of discretion” standard. ***United States v. Nixon*** [2012] 694 F.3d 623, 635 (6th Cir.). Under this standard, a trial judge’s decision may only be reversed if the appellate court is left with “a definite and firm conviction that the trial court committed a clear error of judgment.” ***Leary v. Daeschner*** [2003] 349 F.3d 888, 904.

⁶³ ***United States v. Piccinonna*** [1989] 885 F.2d 1529, 1536 (11th Cir.) (en banc) (“Thus, evidence that a witness passed a polygraph examination, used to corroborate that witness’s in-court testimony, would not be admissible under Rule 608 unless or until the credibility of that witness were first attacked.”).

⁶⁴ ***United States v. Scheffer*** [1998] 523 U.S. 303.

⁶⁵ *Id.* at 306.

⁶⁶ *Id.* at 305-06.

⁶⁷ *Id.* at 306.

⁶⁸ *Id.* at 307.

jury's role as the ultimate trier of fact; and (3) the potential for collateral "mini-trials" to determine the admissibility of polygraph evidence.

On the first point, the Court opined that there was "simply no consensus that polygraph evidence is reliable."⁶⁹ Given this reality, the Court sympathized with the position of the many states that maintained a *per se* ban on polygraph evidence. Moreover, in light of the controversy surrounding the reliability of polygraphs, it credited the military's desire not to have prolonged collateral litigation over the admissibility of such evidence.⁷⁰

But the Court also stressed the need to "preserv[e] the court members' core function of making credibility determinations in criminal trials."⁷¹ It cited the longstanding maxim of American criminal justice that "the *jury* is the lie detector."⁷² Polygraphs, bearing an "aura of infallibility," could encourage jurors "to abandon their duty to assess credibility of guilt."⁷³ In other words, there was a fear that jurors, seeing a polygrapher "clothed . . . in scientific expertise and . . . offering a conclusion about the ultimate issue in the trial," would accept—without hesitation—the expert's take on the case.⁷⁴

The same concerns inhere within neuroscience evidence that would be used to rehabilitate a witness's character for truthfulness under Rule 608. Both before and after *Scheffer*, the Court has made clear that "[o]ur legal system . . . is built on the premise that it is the province of the jury to weigh the credibility of competing witnesses."⁷⁵ Much like polygraph evidence, lie detection provided via fMRIs, EEGs, or other available technologies risk compromising the jury's task of "determining the reliability of the evidence presented at trial,"⁷⁶ thereby depriving jurors of the ability to "decide for [themselves] whether [they] can recognize the truth."⁷⁷

⁶⁹ *Id.* at 309.

⁷⁰ *Id.* at 314.

⁷¹ *Id.* at 312-13.

⁷² *Id.* at 313.

⁷³ *Id.* at 314.

⁷⁴ *Id.*

⁷⁵ ***Kansas v. Ventris*** [2009] 556 U.S. 586, 594 n.*.

⁷⁶ ***Perry v. New Hampshire*** [2012] 132 S. Ct. 716, 723 (U.S.).

⁷⁷ ***Foster v. California*** [1969] 394 U.S. 440, 447 (Black, J., dissenting).

Consider this hypothetical. John Smith is on trial for conspiring to distribute a controlled substance, such as methamphetamine or crack cocaine. The prosecution contends that Smith concocted the scheme with Jay Jones. (Jones, who is also on trial, invokes his privilege against self-incrimination.) Smith denies any involvement with the scheme. In support of its case, the prosecution introduces the testimony of Jane Doe, who overheard a series of conversations between Smith and Jones—unbeknownst to the two—proving the conspiracy.

But Doe is far from the perfect witness. She has a history of deceitful conduct, including a federal conviction for perjury. The defense uses this as ammunition to attack Doe's character for truthfulness, leaving her credibility in tatters. If this marked the end of Doe's testimony, a jury may be disinclined to believe that Doe actually overheard the conversations in question, especially if the defense can attribute some ulterior motive for deception (e.g., bias against Smith or Jones) to Doe.

The prosecution, however, views this as an opportunity. With Doe's propensity for truthfulness now under siege, the prosecution is permitted under Rule 608 to introduce rebuttal evidence rehabilitating Doe's character for truthfulness. And what better evidence than fMRI or EEG results indicating no deception—the examination having been taken while Doe was being questioned by prosecutors or police investigators? While the jury is to consider the evidence as probative only of Doe's truthfulness, there is a strong temptation to take the next logical leap forward and conclude that, in light of Doe's infallibly truthful testimony, Smith must be guilty.

In this scenario, the trial judge would have a few options to limit any undue prejudicial effects that the extrinsic and rehabilitative evidence would have. The judge could issue a limiting instruction, instructing the jury to treat the neuroscience evidence as purely probative of Doe's credibility. The judge could limit the line of questioning for an expert witness explaining the results of fMRI/EEG examination. Nevertheless, it is debatable as to whether such measures would be adequate in combatting any improper usurpation of the jury's function as the sole decider of ultimate issues. Until adequate safeguards can be put into place, a *per se* ban on neuroscience evidence introduced under Rule 608 may perhaps be warranted.

CONCLUSION: THE INTERNATIONAL CONSEQUENCES OF NEUROSCIENCE IN THE COURTROOM

Over the next few decades, courtrooms all across the United States will continue to grapple with the consequences of a technology that is, for now, still in its infancy. But these concerns are not unique to the United States; as one scholar notes, “the question of compelling neuroscientific evidence strikes to the heart of privacy issues and other related human rights concerns.”⁷⁸

Consider the European Convention on Human Rights. Article 8 of the Convention protects the right to respect for private life, and the fair trial guarantees of Article 6 have been understood to protect a defendant’s right to silence. These two provisions serve as European analogues for the Fourth Amendment and the Self-Incrimination Clause.⁷⁹ The European Court of Human Rights has already drawn a distinction between the “physical” and the “testimonial,” laying in the groundwork for potential challenges to compelled neuroscience testing.⁸⁰ It is not difficult to take the next step forward and ask whether such testing intrudes upon the rights guaranteed by Articles 6 and 8.

In the sentencing arena, certain questions of comparative law have been obviated by new legal developments. For instance, a Grand Chamber of the European human rights court recently concluded that life imprisonment without the “chance to someday regain . . . [one’s] freedom” violated Article 3 of the Convention, which prohibits “inhuman or degrading treatment or punishment.”⁸¹ This makes much our Eighth Amendment jurisprudence a moot point for comparison. Still, there are other pressing questions as to how to incorporate neuroscience evidence in crafting “lesser” sentences.

⁷⁸ CHURCH Dominique J., 2012, p. 1842, **Neuroscience in the Courtroom: An International Concern**, *William and Mary Law Review*.

⁷⁹ BERGER Mark, 2006, p. 366, **Europeanizing Self-Incrimination: The Right to Remain Silent in the European Court of Human Rights**, *The Columbia Journal of European Law*; NELSON Kristopher A., 2009, p. 339, **Transnational Wiretaps and the Fourth Amendment**, *Hastings Constitutional Law Quarterly*.

⁸⁰ **Jalloh v. Germany** [2006] 2006-IX Eur. Ct. H.R. 281 (distinguishing between procedures for obtaining a breath test or a blood sample against procedures “interfering with the suspect’s right to respect for private life” that necessarily implicates “the principle against self-incrimination”).

⁸¹ **Case of Vintner and Others v. United Kingdom** [July 9, 2013] Case Nos. 66069/09, 130/10, 3896/10 (Eur. Ct. H.R.).

Finally, the evidentiary considerations raised by “neuroevidence” are not limited to the United States alone. Despite the diversity in how the rules of evidence are structured in each country, the same concerns of avoiding “mini-trials” and protecting the role of the trier of fact remain with every court of first instance. While such issues do not necessarily rise to the level of constitutional importance, they are nevertheless an integral part of a trial judge’s ability to maintain the integrity of the courtroom.

It is still too early to determine whether the law-and-neuroscience trend will fall flat, or conversely, inspire the next great legal debate. But as neuroscience technology becomes more widely available and reliable, it becomes increasingly likely that evidence derived from such technology will raise the questions introduced in this report. As a legal community, we must take proactive steps to confront such challenges and develop well-prepared and well-reasoned responses to address them.

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18 U.S.C. § 3582

Procedural Rules

Fed. R. Evid. 607

Fed. R. Evid. 608