

THE POSSIBILITIES AND PERILS OF NEUROSCIENCE IN CRIMINAL LAW

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The brain plays an integral role in criminal law, whether it comes to determining what a defendant was thinking at the time of a crime or what behavior a convict is predisposed to commit in the future. Neuroscience provides a potential avenue to better understand these mental aspects of criminal trials. As the scientific field continues to grow and change, courts should be careful about the way in which they use neuroscience evidence and what weight such evidence is given.

Many different types of brain scans—including electroencephalography (“EEG”) and functional magnetic resonance imaging (“fMRI”)—have been employed in criminal courtrooms for different purposes. An EEG measures the brain’s electrical activity through electrodes placed on the scalp, and is most commonly used to test a defendant’s memory recognition.¹ EEGs are used to assess the truth of an individual’s statement, like a defendant’s alibi that they have never been to a crime scene.² In order to record brain functioning, fMRIs follow blood flow to particular regions of the brain and superimpose these “hot spots” onto a three-dimensional computer image of the brain itself.³ Both of these scans are employed while the defendant undergoes a series of questions or other stimuli.⁴ The electrical activity or “hot spots” are recorded as reactions to specific questions.

The Supreme Court has considered more general neuroscience evidence in some criminal cases, including a recent series of decisions involving juveniles. First, in *Roper v. Simmons*, the Court outlawed the death penalty for defendants under eighteen years of age.⁵ The *amicus* briefs frequently cited to neuroscience data to establish that an adolescent’s brain has not fully matured.⁶ The Court ultimately found

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¹ Francis X. Shen, *Neuroscience, Mental Privacy, and the Law*, 36 HARV. J.L. & PUB. POL’Y 653, 683–87 (2013).

² *Id.*

³ E. Spencer Compton, *Not Guilty by Reason of Neuroimaging: The Need for Cautionary Jury Instructions for Neuroscience Evidence in Criminal Trials*, 12 VAND. J. ENT. & TECH. L. 333, 339–340 (2010).

⁴ Shen, *supra* note 1, at 684.

⁵ *Roper v. Simmons*, 543 U.S. 551, 551 (2005).

⁶ Stephen J. Morse, *Criminal Law and Common Sense: An Essay on the Perils and Promise of Neuroscience*, 99 MARQ. L. REV. 39, 66 (2015).

this argument persuasive.⁷ Second, the Court explicitly cited to neuroscience when it outlawed life without parole for non-homicide juvenile defendants in *Graham v. Florida*.⁸ The Court quoted a brief from the American Medical Association which stated that “developments in psychology and brain science continue to show fundamental differences between juvenile and adult minds.”⁹ Most recently, in *Miller v. Alabama*, the Court extended the prohibition on juvenile life without parole sentences to homicide defendants.¹⁰ In doing so, the Court noted the “ever-growing body of research in developmental psychology and neuroscience” that continued to confirm the differences between a juvenile and adult mind.¹¹ The level of comfort the Court shows in giving weight to neuroscience in these cases suggests this sort of evidence may play an important role in future criminal proceedings.

I. NEUROSCIENCE EVIDENCE IN TRIALS

In trial court proceedings, both prosecution and defense counsel offer neuroscience as evidence in the guilt and sentencing phases.¹² Prosecutors can employ this evidence to bolster the potential future dangerousness of the defendant. However, using neuroscience data as a weapon raises unresolved constitutional issues surrounding defendants’ Fourth Amendment protection of brain functions from warrantless searches and Fifth Amendment protection from self-incriminating brain scan results. Defendants also use this evidence as a shield, attempting to negate the requisite *mens rea* of a crime or provide an insanity defense. But the unsettled nature of this scientific field may prevent lawyers from raising neuroscience defenses or judges and juries from understanding and according with such defenses.

A. Use Against Criminal Defendants

Brain scans are put to multiple uses by prosecutors. In capital cases, potential for future dangerousness is an aggravating factor the jury considers when deciding between the death penalty and life without parole.¹³ In order to persuade the jury that the defendant is likely to commit future crimes if allowed to live, prosecutors can introduce

⁷ *Roper*, 543 U.S. at 569 (citing immaturity and underdeveloped sense of responsibility in its ruling).

⁸ *Graham v. Florida*, 560 U.S. 48, 48 (2010).

⁹ *Id.* at 68.

¹⁰ *Miller v. Alabama*, 132 S. Ct. 2455, 2457–58 (2012).

¹¹ *Id.* at 2464 n.5.

¹² Compton, *supra* note 3, at 341.

¹³ Adam Lamparello, *Using Cognitive Neuroscience to Predict Future Dangerousness*, 42 COLUM. HUM. RTS. L. REV. 481, 483 (2011).

neuroscience evidence that suggests that the way a particular defendant's brain functions actually limits his cognitive abilities or impulse control, and predisposes him or her towards erratic or violent behavior.¹⁴ Additionally, fMRIs can be used as a new form of lie detection in all criminal cases. When someone is presented with something he or she recognizes, there is a reactionary spike in brain functioning. By mapping this spike in a defendant's brain when the defendant is shown a picture of a crime scene or victim he or she claims to have no knowledge of, the fMRI presents potentially damaging evidence.¹⁵ Studies show that fMRIs are not often employed presently to assess the truthfulness of testimony,¹⁶ but as the sophistication of these scans progresses and courts become increasingly comfortable with them, this form of lie detection could become an increasingly viable prosecutorial tool.

Using the scans and reactions of a defendant's brain in this manner would potentially implicate both Fourth and Fifth Amendment concerns. The Court has found a reasonable expectation of privacy protected by the Fourth Amendment in compelled tests of a defendants' bodily contents like blood and urine in *Skinner* and *Schmerber*.¹⁷ It seems that this same protection would cover the bodily contents of brain cells and blood flow within the skull.¹⁸ But both *Skinner* and *Schmerber* addressed analysis of material extracted from the defendant's body, while fMRIs and EEGs are non-invasive procedures. Analogizing to other Fourth Amendment precedent, brain waves are continuously and automatically produced similar to heat waves generated from lamps used to grow marijuana plants. In *Kyllo v. United States*, the Court held that monitoring those heat waves through a thermal imaging device required a warrant.¹⁹ Accordingly, bodily functions measured in brain scans may merit the same protection as other bodily functions, and the fact that these scans do not require physical invasion does not make them constitutional. Therefore, brain scans could require the same Fourth Amendment protection from neuroscience imaging.²⁰

Additionally, brain scans reveal information about a defendant that may be subject to Fifth Amendment protection from self-incrimination if that information is classified as testimonial rather than physical evidence.²¹ Though scans are basically computer records of brain waves

¹⁴ Deborah W. Denno, *The Myth of the Double-Edged Sword: An Empirical Study of Neuroscience Evidence in Criminal Cases*, 56 B.C. L. REV. 493, 526 (2015).

¹⁵ Shen, *supra* note 1, at 680–83.

¹⁶ Denno, *supra* note 14, at 544.

¹⁷ *Skinner v. Ry. Labor Exec. Ass'n*, 489 U.S. 602, 615–18 (1989) (urine); *Schmerber v. California*, 384 U.S. 757, 766–72 (1966) (blood).

¹⁸ Shen, *supra* note 1, at 699.

¹⁹ *Kyllo v. United States*, 533 U.S. 27, 27 (2001).

²⁰ Shen, *supra* note 1, at 699.

²¹ *Schmerber*, 384 U.S. at 764 (“The distinction which has emerged, often expressed in

and electrical pulses that seem to be physical in nature, scans are actually more testimonial since the relevant data is prompted by responses to questioning.²² Furthermore, since the data itself is not the key evidence but rather the inference that is drawn from the fMRI scans about the defendant's state of mind, the necessary interpretation of the evidence further removes its physical nature.²³ As prosecutors become increasingly comfortable with the use of neuroscience evidence, courts will likely be forced to answer these Fourth and Fifth Amendment questions.

B. Use by Criminal Defendants

Defendants use neuroscience evidence more frequently than prosecutors to present fact-finders with a more complete set of circumstantial information. This is generally done in an attempt to avoid or mitigate punishment.²⁴ Defendants can cite to this data both to negate the requisite *mens rea* of a crime and to claim a defense of insanity.

Neuroscience evidence may uncover causal relationships between brain functions, emotions, and understandings.²⁵ For example, depression, addiction, and racial perception could eventually be linked to specific activities within the brain.²⁶ As such, it can shed light on a defendant's state of mind in the commission of a crime or his or her *mens rea*. For example, a murder defendant in Missouri offered expert evidence suggesting his brain damage-induced depression and paranoia made him incapable of the deliberate premeditation required for a first degree murder conviction.²⁷ This defense, however, failed. Legal scholars have suggested defendants use more traditional facts, like their behavior at the time of the crime,²⁸ until neuroscience becomes a more settled field.

Apart from *mens rea*, defendants have successfully used neuroscience to bolster the insanity defense. In *Ake v. Oklahoma*, the Court held that the state is required to provide a psychiatric evaluation

different ways, is that the privilege is a bar against compelling 'communications' or 'testimony,' but that compulsion which makes a suspect or accused the source of 'real or physical evidence' does not violate it.").

²² *Id.* at 704.

²³ *Id.*

²⁴ Denno, *supra* note 14, at 544.

²⁵ Compton, *supra* note 3, at 340.

²⁶ *Id.*

²⁷ State v. Anderson, 79 S.W.3d 420, 433 (Mo. 2002).

²⁸ Teneille Broan & Emily Murphy, *Through a Scanner Darkly: Functional Neuroimaging as Evidence of a Criminal Defendant's Past Mental States*, 62 STAN. L. REV. 1119, 1197-98 (2010).

when the defendant's sanity is in question,²⁹ allowing defendants to offer neuroscience evidence to show insanity. In perhaps the most infamous example, John Hinckley, the attempted assassin of then-President Ronald Reagan, offered a brain scan showing an organic brain disease in his successful claim of insanity.³⁰ Additionally, the failure of defense lawyers to use neuroscience evidence for mitigating claims of mental deficiencies has been used to successfully claim ineffective assistance of counsel.³¹ In sum, neuroscience has the ability to play a crucial role in a defendant's case.

II. CONCERNS

Despite the options neuroscience provides to both parties in a criminal trial, the admission of brain scans can confuse judges and juries and raises concerns about the reliability of evolving science in the courtroom as a whole.

As the field of neuroscience grows, it is possible that brain scans, particularly newer images from fMRIs, may begin to be consistently admitted to juries.³² The admission of this complex and evolving form of evidence raises numerous concerns about its effects on juries. Because fMRI scans are highly technical and complex materials, jurors may fail to understand the correct applications and limitations of fMRIs as evidence in court. Jurors could place too much weight on fMRI evidence because of its sophistication. As a result, the importance the jury places on this type of evidence could override the jury's role in factual determinations.³³ Jurors are the sole deciders of what evidence is believable, and how much weight it should be given. It is imaginable that jurors could give undue deference to the perceived infallibility of scientific data, and fail to independently judge the validity of fMRI evidence.

Jurors' confusion with and potential deference to neuroscience is a particularly important concern, as currently available neuroscience evidence presents limited probative value.³⁴ Brain scans rely on data of how people's brains generally react to different stimuli and cannot fully explain actions on an individual basis.³⁵ Many different external factors play a role in a brain's functioning during a particular situation.³⁶

²⁹ 470 U.S. 68, 68 (1985).

³⁰ *United States v. Hinckley*, 525 F. Supp. 1342, 1348 (D.D.C. 1981).

³¹ At least seventy-four neuroscience related ineffective assistance of counsel claims were raised between 1992 and 2012. Denno, *supra* note 14, at 493.

³² Compton, *supra* note 3, at 337.

³³ *Id.* at 345–46.

³⁴ See Compton, *supra* note 3, at 337–48.

³⁵ Broan & Murphy, *supra* note 28, at 1182–83.

³⁶ Compton, *supra* note 3, at 344–45.

Therefore, it may be difficult to determine a reliable baseline from which to determine whether the defendant's reaction to a suggested prompt caused the readings, implying that the defendant is lying.³⁷ Any reaction could also be the result of an irrelevant factor, such as a defendant's mind reacting to something else entirely separate from the criminal case at hand.³⁸ This is referred to as the "reverse inference" fallacy, suggesting that when the area of the brain associated with lying is activated, "it is not lying *per se* that is being decoded from these brain areas but rather the cognitive and emotional processes that are associated with lying."³⁹ Additionally, fMRIs and EEGs are based on simple experimental questioning, making the results hard to extrapolate onto the complex functioning of daily life events.⁴⁰ EEG and fMRI findings could become more relevant if defendants were subject to questioning or scenarios more closely related to the alleged crime, but they still may not provide a tool to judge a past mindset. Accordingly, they shed a limited light on mental elements like *mens rea*.⁴¹

Outside of the jury box, overreliance on neuroscience evidence poses a number of problems to criminal law as a whole. Taken to its furthest extreme, neuroscience could undermine the retributive justification of punishment.⁴² If an electrical function of the brain can prompt all action and thought, then the latter are in a sense pre-determined. As such, no offender is truly responsible for the result of their deed.⁴³ Professor Stephen Morse refers to this phenomenon as "neuro-arrogance."⁴⁴ Neuroscience can and should be used to inform criminal law, but it is not capable of dictating the aims of a criminal justice system in a profound way.⁴⁵ Legislators, judges and lawyers build and operate criminal law and determine the limits and reasonableness of punishment based on society's agreement of accepted norms. This foundation is not something that can be wholly derived from scientific fact.

American courts have a history of overemphasizing science in their decisions. Advances like the polygraph test, fingerprint analysis, and early DNA evidence all initially had the endorsement of scientists and were presented with an aura of legitimacy to which courts deferred.⁴⁶ However, empirical studies later confirmed all of these sources of

³⁷ *Id.*

³⁸ *Id.*

³⁹ Shen, *supra* note 1, at 681.

⁴⁰ Compton, *supra* note 3, at 344–45.

⁴¹ Broan & Murphy, *supra* note 28, at 1187–88.

⁴² Morse, *supra* note 6, at 44.

⁴³ *Id.*

⁴⁴ *Id.* at 69.

⁴⁵ Francis X. Shen, *Sentencing Enhancement and the Crime Victim's Brain*, 46 LOY. U. CHI. L.J. 405, 440–41 (2014).

⁴⁶ Broan & Murphy, *supra* note 28, at 1205–06.

evidence to pose serious risks of reliability and validity.⁴⁷ Further neuroscientific research may well expose the same issues in current brain scanning technology. The error of science run rampant in courtrooms has resulted in improper convictions, and notoriously led to a declaration that eugenics proved “three generations of imbeciles” were enough to condone a practice of forced sterilization of people with disabilities.⁴⁸ Neuroscience presents an opportunity to delve much deeper into the mind of a criminal defendant, and could produce radical changes in evidentiary practices. However, all progress must be tempered by caution and introspection to ensure that criminal law’s principles are not swallowed by a supposed truth that turns out to be anything but.

⁴⁷ *Id.*

⁴⁸ *Buck v. Bell*, 274 U.S. 200, 207 (1927) (upholding forced sterilization of people with disabilities due to the likelihood they will have disabled children who will “sap the strength of the State”).