Neuroimaging in Criminal Trials: Evidentiary and Constitutional Concerns

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INTRODUCTION

In an idealized case—where published, peer-reviewed, and uncontroverted research has demonstrated a causal relationship between a particular brain anomaly and a specific criminal behavior, and where a skilled professional has conducted a neuroimaging test that unambiguously shows the existence of such an abnormality in a defendant’s brain—neuroimaging evidence would be helpful in explaining to a jury why the particular defendant lacked the requisite mens rea that would render him legally culpable for his actions. Imposing punishment in such a case arguably could not be justified under a theory of specific deterrence, because the defendant’s criminal behavior would have been impelled by an anatomical force beyond his control; and if it were the type of abnormality (such as a tumor) that could be fixed by medical intervention, the impulse to commit the crime should vanish upon receipt of treatment. Moreover, notions of retributive justice would seem misplaced, because it was not “bad will” but rather bad physiology that drove his actions. If the defendant’s tumor were excised or his cognitive dysfunction remedied, punishing him would be like punishing a fundamentally different person.

The trouble is that given the current state of the art, establishing such a direct, unequivocal chain of causation between the faulty condition of a defendant’s brain and his deviant conduct will rarely if ever be possible. Thus, there is a realistic concern that use of neuroimaging in court may mislead lay jurors into wrongly attributing a purported brain abnormality as the proximate cause of the defendant’s conduct. During the case-in-chief, this could result in an unwarranted finding that the prosecution was unable to prove the specific intent element of the crime, or in an undeserved “not guilty by reason of insanity” (“NGRI”) verdict. Related concerns about mistaken conclusions arise during competency hearings and during the sentencing phase of the trial.

Although interest in the neurological basis of criminal behavior has existed in various forms for centuries, the potential for neuroimaging to be employed as part of a defense strategy gained social prominence during the trial of John Hinckley for his attempted assassination of then-President Reagan, when Hinckley’s expert witnesses incorporated the technology into their testimony supporting Hinckley’s insanity defense.¹ While the general issue of neuroimaging in criminal trials has reemerged throughout the years thereafter, technological sophistication and scientific knowledge have drastically advanced, rendering even some relatively contemporary judicial precedent outdated. The physical sciences have seen an explosion of research interest in the biological basis of crime in recent years. Yet, while the results of these studies have been embraced by psychiatrists and psychologists, much of the legal profession has been less enthusiastic about incorporating such findings into its general understanding of criminology.² These scientific studies have associated criminal misconduct with an ever-growing array of

² See Adrian Raine, The Biological Basis of Crime, in CRIME: PUBLIC POLICIES FOR CRIME CONTROL 43-74 (J.Q. Wilson & J. Petersilia eds. 2002) (suggesting that this reluctance may be due to “interdisciplinary rivalries,” “a lack of understanding,” and “deep-seated historical and moral suspicions of a biological approach to crime causation”).
biological factors, ranging from genetic predispositions that detrimentally combine with negative environmental circumstances, to an array of other psychophysiological considerations including birth defects, physical anomalies, hormonal imbalances, neurotransmitter abnormalities, and nutritional deficiencies. This article considers only one of these areas of inquiry—specifically, the structural and functional characteristics of the brain that can be observed through modern imaging techniques.

As the potential of such neuroimaging techniques to be utilized in criminal trials moves from an interesting theoretical matter for legal academics and philosophers to ponder, to an impending reality for prosecutors and defense attorneys alike, clarity and coherence in policymaking become crucial. Proponents and detractors of what is popularly described as “neurolaw” see the possibility of neuroscientific evidence to influence “questions of guilt and punishment,” “detection of lies by witnesses,” “hidden bias in jurors,” and “prediction of future criminal behavior.” Thus, to further moderate the scope of this article, its focus is narrowed to the use of neurological test results as evidence of a criminal defendant’s mental state, whether for determinations of competency to stand trial, as part of an insanity defense, or as a mitigating (or possibly aggravating) factor in sentencing, particularly in the context of capital punishment.

The article’s major theoretical and substantive themes can be divided into two parts. First, the article addresses the federal and state rules of evidence, as well as the case law interpreting these rules, that will organize judicial decisions regarding the admissibility of brain imaging data and the scientific expert testimony explaining it. Second, the article considers U.S. Supreme Court jurisprudence informing judgments about the constitutionality of allowing or prohibiting criminal defendants to submit neuroscientific evidence to the factfinder. Significantly, these decisions indicate that neuroimaging will be treated differently throughout the various phases of a criminal trial, depending on how the judge as “gatekeeper of the evidence” is instructed to weigh procedural and constitutional concerns. Thus, this article makes both recommendations and predictions about how neuroimaging will be employed in competency determinations (to stand trial, to plead guilty, to withdraw a plea, and so forth), in the criminal trial itself (either to negate mens rea or to support an insanity defense), and in sentencing proceedings.

The article concludes by noting that precedential judicial construction of the Federal Rules of Evidence and the U.S. Constitution is consistent with the article’s normative proposals. Specifically, this article finds that neuroimaging frequently should be admissible as a mitigating factor in sentencing decisions, particularly when capital punishment is a possibility. It often will be appropriate persuasive (though generally not dispositive) evidence in competency decisions as well. The presumption in favor of admitting such evidence will be strongest when the testing comprises a part of the testifying expert’s typical diagnostic procedures and can help inform the factfinder as to how the expert arrived at her conclusions. However, the use of neuroimaging in the “guilt or innocence” stage of the proceedings still ought to be somewhat constrained due to its potential to manipulate or confuse a jury into unjustifiably convicting or exonerating a defendant. District courts must balance respect for the jury’s intelligence and ability to weigh conflicting scientific testimony on the one hand, with the need to keep pseudoscientific claims and flashy, time-consuming, distracting presentations out of the courtroom on the other. A flexible approach at all stages is critical, so that as the relevant technology continues to develop

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3 Id. at 43-44.
and the neurological correlates of criminal behavior are further established, the judicial system can adapt accordingly.

The objective of this article is to explore the legal and normative concerns implicated by the use of neuroimaging in the courtroom. Although basic familiarity with the fundamentals of neuroscience would aid policymakers and scholars of other disciplines in their assessment of the claims of both advocates and detractors of neurolaw, for reasons of scope this article omits or limits to footnotes discussion of the relevant technology and research literature. Note, however, that while information derived from such technology and academic literature generally is excellent for assisting in clinical diagnoses (where conclusions can be modified or even completely overturned over time, depending on the response and long-term behavior of the patient), for directing further research efforts, and for helping to provide a more comprehensive understanding of the brain, there are compelling arguments against the use of such studies in court. This is especially true given the present failure of neuroscientific research to show any perfect, one-to-one correlation between specific criminal behaviors and purportedly related areas of the brain.

To elaborate, even the best studies cannot achieve perfectly consistent results either between experimental trials or among patients, due to the complex ways in which the many parts of the brain interact with each other and with the subject’s external environment. As a result, it is impossible to attribute a particular action to a single, specific, and consistent neurological cause. Generally, then, identification of these structures and the functions they perform is useful for the (albeit often quite strong) statistical correlations with particular criminal dispositions that are of interest to an academic researcher, but will be insufficient to establish actual causation in a court of law. Moreover, any particularized guidelines about precisely which areas of the brain can be evaluated by which specific types of technology for the purposes of supporting a limited list of designated propositions would have to be revised on a continual basis as new studies are released, old beliefs overturned, and better technology introduced. Therefore, while the courts may find neuroimaging to be quite suggestive in certain mental status determinations, the results of such tests viewed in isolation should not be considered dispositive.

Thus, while research findings valuably contribute to neuroscience as a broad field of inquiry, they provide only generalized averages and correlations that may not reliably reflect the causal mechanisms at work in a particular defendant. Moreover, the various types of neuroimaging techniques each have their respective strengths and weaknesses; even neuroscientists and social science researchers who are enthusiastic about the promise of neurolaw are careful to acknowledge the limits of neuroimaging technology, noting that even the most modern machines “are not diagnostic in that they do not perfectly predict who is violent and who is not.” Nonetheless, the probative value of emerging techniques like PET and fMRI

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5 For an excellent review of the current uses of neuroimaging as an aid to understanding criminal and violent behavior, see Joseph H. Baskin et al., *Is a Picture Worth a Thousand Words? Neuroimaging in the Courtroom*, 33 AM. J.L. & MED. 239 (2007). The article presents the latest research and proposals for further study on a continuum, ranging from the strongest correlations, to areas that seem to hold promise, to situations where the connection is too speculative to be viable in court.

6 Raine, *supra* note 2, at 73.

7 Positron emission tomography (PET) uses certain radioactive isotopes as biological tracers, which are injected into the subject’s bloodstream and which emit positrons as they decay. The circular gamma ray detectors of the PET machine detect gamma rays emitted when the positrons contact and annihilate electrons, and then feed the data back to a computer indicating the pathway along which the annihilation occurred. When this information is aggregated over a period of time, the PET scan allows determination of differential metabolic and biochemical activity within
have a probative value stronger than EEG\textsuperscript{9} and other neuropsychological test data that courts have admitted into the evidentiary record in the past.\textsuperscript{10} There is also an emerging practice in forensic and clinical neuropsychology of imaging the subject’s brain with more than one type of machine, such that the respective merits of each meliore the others’ shortcomings. Although an obvious additional monetary cost accompanies this practice, the gain in accuracy from using complementary techniques may make the extra expenditure worthwhile. This article thus finds that ultimately, and especially when utilized in conjunction with other behavioral and neuropsychological evidence, the accuracy of medical diagnoses and expert opinions that incorporate neuroimaging techniques may rise to a level that should allow attorneys on both sides of a criminal trial to present such evidence in full to lay juries and judges.

**PART ONE: THE RULES OF EVIDENCE**

Although one could make the argument that showing images of the brain is no different than presenting pictures of any other internal organ, even most supporters of neurolaw are willing to concede that the brain is probably the most complex and least understood aspect of human anatomy, and that additional dangers arise when moving from the use of neuroimaging results to prove structural brain damage in a tort case to using them in a criminal trial to make the area studied. Among the many ways in which these results can be used, those with possible relevance to the criminal trials include the ability to diagnose trauma by studying the brain in three dimensions, and to measure and monitor neuronal activity and chemistry in areas associated with different mental functions. See generally Stacey A. Tovino, *Imaging Body Structure and Mapping Brain Function: A Historical Approach*, 33 AM. J.L. & MED. 193, 212-14 219-22 (2007).\textsuperscript{8} Functional magnetic resonance imaging (fMRI) measures hemodynamics—changes in the brain’s blood flow and blood oxygenation—resulting from active nerve cells consuming oxygen in hemoglobin, increasing blood flow and volume to the area of activity. fMRI monitors the magnetic susceptibility of hemoglobin, which varies depending on whether or not it is oxygenated. Despite demonstrable benefits to scientific research and in clinical application, however, doubts linger regarding the appropriateness of introducing the technology into the courtroom. For instance, since the hemodynamic response lasts longer than the base neural activity that it is indirectly trying to measure, it is unclear whether small changes in blood flow (which themselves may not be significant) are indicative of input-processing activity or output activity. Indeed, especially given both that interpreting fMRI scans arguably involves a considerable amount of subjective judgment, and that even small movements by the subject during testing can interfere with the results, it can be difficult to identify the underlying cause of hemodynamic changes. See generally SCOTT A. HUETTAL ET AL., *FUNCTIONAL MAGNETIC RESONANCE IMAGING* (2004); see also Tovino, *supra* note 7, at 219-22.\textsuperscript{9} An electroencephalogram (EEG) uses electrodes placed on the subject’s scalp to measure the electric voltage of the inhibitory or excitatory charges that exist on the post-synaptic membranes that contribute to inter-neuronal connections. The “brain wave” patterns recorded by the EEG unit are interpreted with consideration given to the subject’s age and level of alertness, and can assist in the diagnosis of seizure disorders, brain damage, and other neurological and medical conditions. See generally A. JAMES ROWAN & EUGENE TOLUŃSKY, *PRIMER OF EEG: WITH A MINI-ATLAS 1-4* (2003). The EEG has a higher time resolution in comparison to other ways of studying the brain like fMRI and PET, and unlike these other technologies, it measures neural activity directly. Seppo P. Ahlfors & Gregory V. Simpson, *Geometrical interpretation of fMRI-guided MEG/EEG inverse estimates*, 22 NEUROIMAGE 323, 323 (2004). However, the spatial resolution of EEG relative to other neuroimaging techniques is generally inferior, and the results are frequently distorted by external and non-cerebral biological artifacts which must be corrected for in analysis. Markus Junghofer et al., *Statistical control of artifacts in dense array EEG/MEG studies*, 37 PSYCHOPHYSIOLOGY 523, 523 (2000).\textsuperscript{10} Raine, *supra* note 2, at 73.
arguments about culpability and future dangerousness.\textsuperscript{11} For this reason, the application of a jurisdiction’s rules of evidence as applied to neuroimaging evidence requires special consideration. Accordingly, this section reviews some of the possible evidentiary objections that opposing counsel might raise against a party that wishes either to present neuroimaging data directly to the jury or to simply offer expert testimony based (in whole or in part) on neuroimaging results. A set of themes recurs throughout the analysis of these rules of evidence: namely, the trial judge should have the discretion to admit or exclude data or testimony based on the particular circumstances of the case, but such decisions should be made with deference to the ability of the jury to intelligently consider the evidence before it, especially since the other side will always have the opportunity to rebut this evidence by cross-examining witnesses and highlighting weaknesses in their opponent’s assertions.

1. Basic Evidentiary Standards
   a. \textit{Reliability under Daubert, Frye, and Rule 702}: Federal Rule of Evidence 702,\textsuperscript{12} and its similar or identical counterparts in state laws, is the codification of the Supreme Court ruling in \textsc{Daubert v. Merrell Dow Pharmaceuticals}.\textsuperscript{13} The rule will guide the criminal trial court judge’s decision about the admissibility of any expert testimony that relies on neuroimaging to support claims about the defendant’s purported mental state during the commission of the crime.\textsuperscript{14} The \textsc{Daubert} opinion stressed that to be admissible, “purportedly scientific evidence” must be “not only relevant, but reliable,”\textsuperscript{15} and must be based on more than the expert’s “subjective belief or unsupported speculation.”\textsuperscript{16} Still, the Supreme Court held that it would be “unreasonable to conclude that the subject of scientific testimony must be ‘known’ to a certainty,” since the scientific method reflects a continually evolving process as additional testing is done, new knowledge is gained, and old theories are refined.\textsuperscript{17} Accordingly, to the extent that a neuroimaging expert can establish that her findings are grounded in sound scientific

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\item See, e.g., Mark Pettit, Jr., \textit{fMRI and BF Meet FRE: Brain Imaging and the Federal Rules of Evidence}, 33 Am. J.L. & Med. 319, 321-23 (2007) (arguing that problems with the admissibility of brain-imaging evidence increase as one moves from using it merely to show brain structure to using it for lie detection, with the irregularities and incertitudes associated with demonstrations of function and explanations/predictions of behavior falling somewhere in between).

\item Federal Rule 702, governing testimony by experts, reads as follows:
   If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.\textsc{Fed. R. Evid. 702}.

\item 509 U.S. 579 (1993).

\item Under Rule 104, “[p]reliminary questions concerning the qualification of a person to be a witness… or the admissibility of evidence shall be determined by the court.” \textsc{Fed. R. Evid. 104(a)}. Appellate courts are highly deferential to the trial judge’s decision of whether to exclude or allow this evidence, reviewing it under an “abuse-of-discretion” standard, notwithstanding the special \textit{Daubert} considerations that must be taken into account for scientific and expert testimony. \textit{See} Gen. Elec. Co. v. Joiner, 522 U.S. 136, 141-43 (1997) (holding that the Federal Rules of Evidence “leave in place the ‘gatekeeper’ role of the trial judge in screening such [scientific testimony] evidence,” and that the “court of appeals applying ‘abuse-of-discretion’ review to such rulings may not categorically distinguish between rulings allowing expert testimony and rulings disallowing it”).

\item \textit{Daubert}, 522 U.S. at 589.

\item Id. at 590.

\item Id.
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principles and methods, are supported by the facts of the particular case, and preferably would be endorsed by a substantial portion of the relevant scientific community, then neuroimaging evidence should not be barred per se.\(^{18}\)

Note, however, that while \textit{Daubert} is the standard for the federal circuit and for many state courts, a significant number of jurisdictions continue to use the earlier-developed \textit{Frye} standard\(^{19}\) or a similar variation of it. The \textit{Frye} test simply asks whether the proffered scientific evidence is “sufficiently established to have gained general acceptance in the particular field in which it belongs.”\(^{20}\) As a result, whereas a judge operating under the \textit{Daubert} rule must decide whether the methodology and analysis of proffered neuroimaging evidence comports with scientific principles, \textit{Frye} allows the experts themselves to testify as to the “standing and scientific recognition”\(^{21}\) among authorities in their field of the procedures or premises at issue.\(^{22}\) This could pull either way when defense counsel wants its expert witness to incorporate neuroimaging findings into her testimony. On the one hand, if a substantial number of professionals within the field of psychiatry or neuropsychology would generally accept the use of neuroimaging in circumstances and for purposes similar to the defendant’s, then a \textit{Frye} rule would not bar the admissibility of the expert’s testimony, notwithstanding the extent to which the underlying methodology separately has been empirically proven. In contrast, a \textit{Daubert} rule would permit an expert to employ and discuss a cutting-edge use of neuroimaging technology even if it had not yet gained widespread acceptance within the field, provided that the expert could scientifically justify that decision. Of course, in either situation, opposing counsel has the opportunity to cross-examine the witness and to underscore any weaknesses in her methodology or the conclusions drawn therefrom.

b. \textit{The Rule 403 Balancing Test}: Under Federal Rule of Evidence 403 and similar state provisions, a trial court may exclude relevant evidence 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.”\(^{23}\) The discretion granted to the judge is broad,\(^{24}\) and even the most reliable and relevant neuroimaging evidence may be particularly vulnerable under this rule. A judge could reasonably find that a jury is likely to give too much weight to such evidence simply because the

\(^{18}\) While declining to set out a “definitive checklist,” the \textit{Daubert} opinion urged trial court judges to weigh five factors that it considered particularly relevant to questions about the validity and reliability of the theory or technique upon which the proffered expert testimony evidence is based: (1) whether it is falsifiable and has been empirically tested; (2) whether it has been subjected to peer review and has been published; (3) what its known or potential rate of error is; (4) the existence and extent of standards controlling its operation; and (5) its general acceptance within the relevant scientific community. \textit{Id.} at 593-95.

\(^{19}\) \textit{Frye} v. United States, 293 F. 1013 (D.C. Cir. 1923).

\(^{20}\) \textit{Id.} at 1014.

\(^{21}\) \textit{Id.}

\(^{22}\) \textit{See, e.g., G. Michael Fenner, The Daubert Handbook: The Case, Its Essential Dilemma, and Its Progeny,} 29 \textit{Creighton L. Rev.} 939, 950-51 (1996) (“[Under \textit{Daubert}] the judge has to decide whether the reasoning is sound within the framework of the scientific method, not just whether others in this field of expertise generally find the reasoning sound within the framework of the scientific method [as under \textit{Frye}].”).

\(^{23}\) \textit{Fed. R. Evid.} 403.

\(^{24}\) \textit{See U.S. v. Abel, 469 U.S. 45, 54 (1984) (“A district court is accorded a wide discretion in determining the admissibility of evidence under the Federal Rules. Assessing the probative value… and weighing any factors counseling against admissibility is a matter first for the district court's sound judgment under Rules 401 and 403 and ultimately, if the evidence is admitted, for the trier of fact.”).
jurors are impressed by its basis in neuroscience.\(^{25}\) Conversely, due to a relatively high level of subjectivity in interpreting many types of brain scans,\(^{26}\) experts from each of the prosecution and the defense could in good faith come to exactly opposite conclusions about the defendant’s mental status, with the testimony of one side effectively canceling out the persuasive value of the other. A trial judge thus could deem presentation of this evidence to be necessarily inconclusive and thus a waste of the court’s time, particularly if it were cumulative to testimony related to other, more conventional psychological testing that also had been implemented.

Furthermore, without any disrespect intended toward the average juror’s intelligence, the judge may question the jury’s ability to understand that correlation does not equal causation, and that damage to a given area of the brain does not necessarily force the defendant to commit the antisocial act at issue. Even if both sides acknowledge that not everyone with damage to a given area of the brain commits certain crimes and that not all people who commit such crimes have damage to that area, and even if the parties stipulate that a finding of neurological abnormalities should not automatically implicate or exonerate the defendant, a trial judge may have grounds to find that the potential confusion or misleading of the jury substantially outweighs the probative value of the evidence. Of course, none of these concerns necessitates that a judge invoke Rule 403 and automatically exclude neuroimaging from the trial record. Rather, they merely indicate that an appellate court would have a sufficient basis to uphold a trial court’s decision to exclude such evidence if it were challenged on appeal.

In practice, the lower courts have ably managed to evaluate expert neuroscience testimony under Federal Rule 702 or similar state Daubert or Frye standards, and have competently exercised their discretion to admit or exclude such evidence under the Rule 403 balancing test or its state law equivalent. The lack of uniform decision-making outcomes\(^{27}\) suggests that the best policy is neither a universal prohibition against nor a legislative pronouncement unrestrictedly in favor of the use of neuroimaging in court. Instead, judge ought to be allowed especially wide latitude to appraise the relevant technology, the expert witness, the

\(^{25}\) The results of a recent study are telling. Researchers recruited three groups of people—neuroscientists, neuroscience students, and average adults with no neuroscience training—and presented them with a series of explanations for various psychological phenomena, some of which were purposely crafted poorly. There were no significant differences between the groups’ abilities to discern which were the bad explanations, except for when the explanation contained the phrase “brain scans indicate.” Both the neuroscience students and the ordinary adults were more ready to accept statements with allusions to neuroimaging findings as valid. See Deena S. Weisberg et al., The Seductive Allure of Neuroscience Explanations, 20 J. OF COGNITIVE NEUROSCIENCE 470 (March 2008).

\(^{26}\) Brickford Y. Brown & Samuel L. Tarry, Jr., Does Your PET Bite? The Misapplication of Brain Scan in Toxic Tort Litigation, 39 FOR THE DEF. 30, 34 (1997) (“Subjective differences in interpretation can occur even between institutions, based on differences in equipment, institutional experience, and protocols.”).

\(^{27}\) Compare People v. Protsman, 105 Cal.Rptr.2d 819 (Cal.App. 4 Dist. 2001) (rejecting, under the Frye standard, defendant’s PET scan evidence of frontal lobe dysfunction proffered to counter the specific intent element of the crime, on grounds that the underlying science had not yet achieved general acceptability at the time), depublished, and People v. Yum, 3 Cal.Rptr.3d 855 (Cal.App. 4 Dist. 2003) (finding that the use of SPECT scans to diagnose post traumatic stress disorder was still too novel a use of the technology to withstand Frye, after hearing critical testimony from prosecution experts), depublished, with People v. Jones, 620 N.Y.S.2d 656 (1994) (finding that the lower court abused its discretion in denying a request for the neurological testing recommended by defendant’s doctor, who believed defendant’s cognitive deficiencies resulted from brain damage and alcoholism), and State v. Anderson, 79 S.W.3d 420 (2002) (allowing the jury to hear testimony grounded in neuroscience that defendant’s depression and paranoia were induced by brain damage, which the jury ultimately did not find credible). See also THE PRESIDENT’S COUNCIL ON BIOETHICS, AN OVERVIEW OF THE IMPACT OF NEUROSCIENCE EVIDENCE IN CRIMINAL LAW (2004) (staff working paper, available at http://www.bioethics.gov/background/neuroscience_evidence.html) (providing a history of cases in which neuroimaging evidence was before the court).
defendant’s test results, and the general circumstances of the case, before making a fact-specific
decision. Nevertheless, as discussed throughout this article, the strength of any presumption
favoring admissibility will wax and wane throughout the various stages of the trial.

c. Relevance under Rule 401: The meaning of “relevant evidence” does not change
throughout the different stages of a criminal trial; it remains “evidence having any tendency to
make the existence of any fact that is of consequence to the determination of the action more
probable or less probable than it would be without the evidence.” The breadth of what
constitutes a fact “of consequence,” however, will vary depending on whether the court is at the
pre-trial, case-in-chief, or sentencing phase of the proceedings, due to statutorily or judicially
defined limitations as well as to reasons inherent in the nature of the procedural stage itself. For
instance, during the mitigation phase of capital cases, relevant evidence is anything that “tends
logically to prove or disprove some fact or circumstance which a fact-finder could reasonably
dee... warrants a sentence less than death.” In contrast, the trial judge or the procedural rules
of the district may put stricter limitations on the range of facts that are “of consequences” during
the case-in-chief with respect to the determination of the defendant’s guilt or innocence.

However, particularly in jurisdictions where the meaning of “relevance” is construed
broadly, most neuroscience evidence that passes the court’s reliability standards by conforming
to sound scientific principles under Rule 702 should also comply with the relevance
requirements of Rule 401. In other words, an expert’s opinion (if believed) that a correctly
performed diagnostic procedure suggests that the defendant has a mental disease or defect makes
the existence of such disease or defect more probable almost by definition. While neuroimaging
findings that are part of the expert’s regular examination protocol generally will constitute a
straightforward instance of relevant evidence, examples of more indirect support, such as studies
demonstrating a significant statistical correlation between a defendant’s apparent organic
neurological condition and a predisposition to criminal behavior, also seem to have probative
value. Thus, as long as the defendant’s mental capacities are an issue for the factfinder to
consider, such evidence should not be excluded under Rule 401 on grounds of irrelevance alone.

2. Additional Rules Governing Expert Testimony

Federal Rule 704 also acts as a general constraint on the testimony of an expert witness
whose conclusions about a defendant’s mental state are based in whole or in part on the
interpretation of neuroimaging data. Specifically, such an expert “in a criminal case” is
prohibited from “stat[ing] an opinion or inference as to whether the defendant did or did not have
the mental state or condition constituting an element of the crime charged or of a defense
thereo,” since “[s]uch ultimate issues are matters for the trier of fact alone.” In practice,
however, this particular rule should not preclude an expert from using or referring to the
structure or function of the defendant’s brain in formulating her opinions on matters about which
she is permitted to testify. Even though the expert may not explicitly state whether she believes
the defendant had the requisite mens rea or was legally insane during the commission of the
crime, Rule 704 does not itself prevent her from explaining how the neuroimaging results display

28 Fed. R. Evid. 401.
described this standard as a “low threshold.” Id.
30 Fed. R. Evid. 704(b).
abnormalities, damage, or dysfunction in the defendant’s brain and how such anomalies could affect the defendant’s behavior or reflect underlying psychiatric or neurological maladies.\textsuperscript{31}

Although most states choose to construct their respective rules of evidence based on the federal model, they are under no obligation to do so. Accordingly, deviations between various states’ sets of rules appear, including with respect to Rule 704: some jurisdictions may allow testimony embracing issues that are ultimately for jury determination, including the issue of insanity.\textsuperscript{32} Courts with a more permissive Rule 704 may be more sensitive to the risks of neuroimaging evidence under a Rule 403 balancing test, since the extra protection, however marginal, of the more prevalent and stricter variant of Rule 704 is absent.

Two final rules regulating expert testimony will moderate the use of neuroimaging in the courtroom. First, even if the court determines that, for any number of reasons, the neuroimaging results themselves are inadmissible, the expert can nevertheless testify about the opinions and inferences she drew from such results, provided that the data is “of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject.”\textsuperscript{33} A balancing test is necessary before the otherwise inadmissible facts or data may be disclosed to the jury by the proponent of the opinion: the court must determine “their probative value in assisting the jury to evaluate the expert’s opinion substantially outweighs their prejudicial effect.”\textsuperscript{34} In any event, opposing counsel may require the expert to justify her use of neuroimaging techniques and to disclose the underlying data during cross-examination.\textsuperscript{35} Thus, when the court determines that it will not admit neuroimaging results proffered by the prosecution or defense as an initial matter, the rules of evidence grant the other side the flexibility to formulate a strategy about whether and when to uncover the data for the jury and bring its validity (and thus the validity of the opposing expert’s opinion) into question.\textsuperscript{36}

3. Character Evidence in Criminal Trials
   a. Rule 404: Character evidence is generally not admissible to prove conduct on a particular occasion, but Federal Rule 404 provides a specific exception in criminal cases for “evidence of a pertinent trait of character offered by an accused, or by the prosecution to rebut the same….”\textsuperscript{37} This rule may influence how and when either the prosecution or the defense can introduce brain imaging as probative of the defendant’s mental state at the time of the crime, but

\textsuperscript{31} See, e.g., Paul R. Rice & Neals-Erik William Delker, Federal Rules of Evidence Advisory Committee, \textit{A Short History of Too Little Consequence}, 191 F.R.D. 678, 712 (2000) (making similar distinctions between what is and is not permissible under the Rule in the context of a psychiatrist’s testimony about schizophrenia).
\textsuperscript{32} See, e.g., \textit{Clark}, 126 S.Ct. at 2725 n.30 (comparing Arizona’s version of Rule 704 to the federal rule).
\textsuperscript{33} \textit{Fed. R. Evid.} 703. Although this rule applies to the federal circuit and many states have adopted their own version of it, some jurisdictions do not permit expert testimony unless its underlying basis is independently admissible. \textit{See Gary B. Melton et al., Psychological Evaluations for the Courts: A Handbook for Mental Health Professionals and Lawyers} 59 (2d ed. 1997). In such courtrooms, depending on any controversy surround the expert’s methodology and whether the court utilizes a \textit{Daubert} or a \textit{Frye} standard, it may be more difficult to get some neuropsychological testimony before the factfinder.
\textsuperscript{34} \textit{Id.}
\textsuperscript{35} \textit{Fed. R. Evid.} 705.
\textsuperscript{36} Clearly the relationship between the various rules governing expert testimony is far more complex than the brief treatment specific to neuroimaging evidence provided here implies. For an example of the evolution, application, and interplay of these rules in one jurisdiction, \textit{see The Houston Law Review et al., Article VII: Opinions and Expert Testimony}, 30 HOUS. L. REV. 797 (1993) (remarking that recent modifications in Texas’s evidentiary rules express increased confidence in jurors’ abilities and in the adversarial system).
\textsuperscript{37} \textit{Fed. R. Evid.} 404(a)(1).
it also raises a number of normative concerns. Throughout the trial, fairness dictates that if the defense introduces neuroimaging results into evidence to argue that the behavior of the accused was compelled by a physiological condition, the prosecution should be able to rebut that evidence with its own experts’ interpretations and criticisms of the defense’s results and conclusions. In the context of character evidence, this prosecutorial opportunity would arise whether the defense was attempting to prove that a defect in the defendant’s brain rendered him vulnerable to a particular criminal deviation from his normal character, or to prove that the defendant’s general personality traits (impulsiveness, aggression, etc.) were symptomatic of a neurological malady beyond his control.

A related but more difficult question is whether the prosecution should be able to compel the defendant to submit to neurological testing in order to rebut more general statements made by defense counsel regarding the character of its client. Suppose, for example, the defense wishes to argue that the defendant is not the type of person who would commit a violent crime, thus bringing certain aspects of his character into issue and under the purview of this rule. Suppose also that the prosecution’s experts have reason to suspect that areas of the defendant’s brain, such as the frontal lobes, are damaged in such a way as to make the defendant more likely to possess characteristics that are related to the nature or circumstances of the crime for which he stands accused. Should the prosecution be allowed request some type of imaging of the defendant’s brain and to introduce evidence that an individual whose brain shares certain distinctive anatomical characteristics with the defendant’s has a statistically high tendency to display personality traits associated with a particular type of criminal behavior (such as propensity to violence, aggression, impulsiveness, deviousness, or lack of remorse), as part of their rebuttal argument?\(^{38}\) Instead of merely having its own expert reexamine the raw data obtained by defense counsel, the prosecution may want to redo the original test, to order different additional tests, or even to request an initial test if the defense did not use neuroimaging but the prosecution’s expert believes that it would be relevant to a diagnosis.

The criminal procedure statutes of the federal circuit and some states indicate that compelled medical and psychiatric examinations—which presumably would include those that traditionally incorporate the use of neuroimaging—would be permissible if the defendant was promulgating a “not guilty by reason of insanity or mental defect” defense.\(^{39}\) Where the procedural rules of the jurisdiction do not directly address the issue, however, a defendant may

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\(^{38}\) That this evidence could potentially be used as a mitigating factor by the defense during sentencing is irrelevant; the prosecution’s strategy would be to first obtain a conviction by showing that the defendant was physiologically predisposed to act in a certain way and to later argue that he could have or should have resisted those impulses, rendering an NGRI verdict or reduction in punishment unwarranted.

\(^{39}\) See, e.g., FED. R. CRIM. P. 12.2(c), (d) (“The court may exclude any expert evidence from the defendant on the issue of the defendant’s mental disease, mental defect, or any other mental condition bearing on the defendant’s guilt or the issue of punishment in a capital case if the defendant fails to... submit to an examination when ordered...”); MINN. R. CRIM. P. 20.03 (“The court… may order a mental examination of the defendant when the defense has notified the prosecuting attorney… of an intention to assert a defense of mental illness or deficiency, … or when at the trial of the case, the defendant offers evidence of such mental condition[;] … If the defendant or prosecution has retained an examiner… the court on request of the defendant or prosecuting attorney shall direct that such examiner be permitted to observe the mental examination and to conduct a mental examination of the defendant also.”); Wis. STAT. § 971.16(4) (“No testimony regarding the mental condition of the defendant shall be received from a physician, psychologist or expert witness summoned by the defendant… unless the prosecution has been afforded an opportunity to examine and observe the defendant if the opportunity has been seasonably demanded.”).
be able to argue that a court-ordered neurological test violates his Fifth Amendment privilege against self-incrimination\textsuperscript{40} or his Fourth Amendment protection against unreasonable searches.\textsuperscript{41}

b. **Compulsory Neuroimaging Evidence:** The U.S. Supreme Court decision in *Schmerber v. California*\textsuperscript{42} which upheld the compulsory drawing of blood in order to test a drunk driver’s blood alcohol level, provides a framework for understanding how compelled neuroimaging procedures may or may not withstand Fourth and Fifth Amendment challenges. Although there is a historical distinction between “communications” and “testimony,” which are protected by the Fifth Amendment privilege against self-incrimination, and “real or physical evidence,” which is not, the *Schmerber* court gave the example of “lie detector tests measuring changes in body function during interrogation” as one of the “many cases in which such a distinction is not readily drawn.”\textsuperscript{43} Although the blood test that was the subject of the *Schmerber* decision was not “testimonial” within the meaning of the Fifth Amendment, compulsory brain scanning seems closer to the type of testing that attempts to determine the subject’s “guilt or innocence on the basis of physiological responses, whether willed or not,” and thus fits more closely to the type of situation in which the privilege is appropriately invoked.\textsuperscript{44}

Based on the *Schmerber* opinion, if the Fifth Amendment “does not bar compelled intrusions into the body” for neuroimaging, the Fourth Amendment’s prohibition against unlawful searches and seizures will still act “to constrain, not against all such intrusions, but against intrusions which are not justified in the circumstances, or which are made in an improper manner.”\textsuperscript{45} Before compelling a criminal defendant to submit to any type of neuroimaging, then, the prosecution likely would have to establish (1) that the testing “is a highly effective means of determining” a fact of material importance to the case; (2) that the test is relatively “commonplace”; (3) that “for most people the procedure involves virtually no risk, trauma, or pain”; (4) that “the test [will be] performed in a reasonable manner” and “in a hospital environment according to accepted medical practices”; and perhaps (5) that the defendant had no basis to object “on grounds of fear, concern for health, or religious scruple.”\textsuperscript{46} The tests themselves, while sometimes time-consuming, tend to be relatively noninvasive, arguably minimizing some of the constitutional concerns about interference with the accused’s bodily autonomy. Still, the *Schmerber* opinion is careful to constrain the reach of its holding:

\textsuperscript{40} The Fifth Amendment provides, in relevant part, that “[n]o person… shall be compelled in any criminal case to be a witness against himself….,” U.S. CONST. amend. V. Arguably, then, a compulsory examination of the defendant’s brain that revealed incriminating structural abnormalities (for instance, damage to an area correlated with impulsive explosive behavior, when the prosecution’s theory of the crime involves an unpremeditated aggressive act) could amount to an unwanted admission or indication of culpability. *See also, e.g.*, Comment to Minn. R. Crim. P. 20.03 (noting that the procedural rule allowing the prosecution to request a compulsory medical examinations also provides the defendant with procedural safeguards to ensure protection of his constitutional rights).

\textsuperscript{41} The Fourth Amendment, in relevant part, ensures “[t]he right of the people to be secure in their persons… against unreasonable searches and seizures.” U.S. CONST. amend. IV. Thus, a defense team could argue that the prosecution is constitutionally precluded from going on an expedition into the defendant’s brain to search for any neurological anomalies that are statistically connected to the mens rea oractus reus at issue, particularly if the prosecution would not be able to “particularly describe[e] the place to be searched” within the brain. *Id.*

\textsuperscript{42} 384 U.S. 757 (1966).

\textsuperscript{43} *Id.* at 764.

\textsuperscript{44} *Id.*

\textsuperscript{45} *Id.* at 768.

\textsuperscript{46} *Id.* at 771.
The integrity of an individual's person is a cherished value of our society. That we today hold that the Constitution does not forbid the States’ minor intrusions into an individual's body under stringently limited conditions in no way indicates that it permits more substantial intrusions, or intrusions under other conditions. Thus, under the Schmerber ruling, both the Fifth and Fourth Amendments may restrict the prosecution’s ability to compel a criminal defendant to submit to any of the various neuroimaging techniques, even when the proposed method has been proven safe and effective. Rules of criminal procedure tend to restrict the admission of character evidence anyway, further diminishing the likelihood that a court would find a compulsory examination appropriate in most circumstances. Although a case-specific inquiry is the best approach as a general matter, when the defense does not introduce neuroimaging evidence first, the prosecution usually will not be justified in ordering the defendant to submit to such testing.

4. Hearsay Evidence
   One final potential evidentiary objection to the presentation of neuroimaging data to a jury is that the expert using and discussing the results may not be the same professional who actually performed the test. Given the presence of many specialties and sub-specialties throughout the medical profession, it is likely that a team of doctors will contribute to the process of gathering neurological information about the defendant, not all of whom will be before the court. In addition to carrying out the neuroimaging procedure itself, such additional doctors may also provide reports or consultations that shape part of the testifying expert’s opinion. To the extent that these results are referenced during the expert’s testimony, then, they fall within the definition of hearsay. However, such evidence will almost always fall under one of the hearsay exceptions. For instance, the exceptions listed in the federal rules allow statements made for the purpose of medical diagnosis or treatment, to help explain why the medical team believed neuropsychological testing was necessary; medical reports, records, and data compilations, kept in the regular course of business within the medical and psychological professions, that state facts, conditions, and opinions relevant to the defendant’s diagnosis; and “learned treatises,” or peer-reviewed publications of relevant studies, to explain why the results of the neuroimaging are consistent with the expert’s diagnosis, or to establish a statistical correlation between the results and certain behavioral predispositions. Moreover, a judge also has ability to allow hearsay evidence into the record even if it does not conform to one of the listed categories, under the Rule 807 residual exception.

47 Id. at 772.
48 Hearsay is “a statement, other than one made by the declarant while testifying at the trial or hearing, offered in evidence to prove the truth of the matter asserted.” FED. R. EVID. 801(c).
49 Fed. R. Evid. 803(4).
50 Fed. R. Evid. 803(6).
51 FED. R. EVID. 803(18).
52 Rule 807 hearsay evidence is admissible at the court’s discretion if the court determines that it has “circumstantial guarantees of trustworthiness,” and that (A) the statement is offered as evidence of a material fact; (B) the statement is more probative on the point for which it is offered than any other evidence which the proponent can procure through reasonable efforts; and (C) the general purposes of these rules and the interests of justice will best be served by admission of the statement into evidence. FED. R. EVID. 807. Criterion (B) may provide opposing counsel with grounds for objection in some situations: while neuroimaging is the most direct and accurate way to prove organic brain damage, other lower-tech procedures (such as in-person evaluations or written personality tests) may be readily performable and equally probative for
In short, then, hearsay objections in and of themselves usually will be a low hurdle to the admissibility of neuroimaging evidence, but because counsel to criminal proceedings can expect resistance from the opposing side in any and every form, such potential challenges should be anticipated and adequate preparations made to meet them.

PART TWO: CONSTITUTIONAL CONCERNS THROUGHOUT THE CRIMINAL TRIAL

The decision of whether or not to use neuroimaging information during any phase of a criminal trial will necessarily entail a strategic judgment on the part of the defendant’s attorneys. For instance, studies have found that defendants who unsuccessfully assert a “not guilty by reason of insanity” (“NGRI”) claim and who are eventually convicted of the crime will serve, on average, significantly longer sentences than defendants who do not attempt the defense. Moreover, not only do juries frequently reject insanity claims, but the vast majority of defendants who are acquitted under an NGRI verdict are hospitalized and ultimately spend more time in custody on average than defendants who were convicted of and imprisoned for the same offense. Defense counsel will need to evaluate whether any neuroimaging evidence, in conjunction with other expert and lay testimony, is sufficiently probative to overcome these odds. Such concerns are practical ones that will structure any criminal defense attorney’s trial strategy. This section of the article, however, is focused more on overarching issues of policy and constitutional rights. Specifically, it examines the extent to which constitutional history and more recent judicial precedent support the use of neuroimaging techniques during the various phases of a criminal trial: competency hearings, the case-in-chief, and sentencing.

Notably, the sentencing guidelines for capital punishment cases in virtually every jurisdiction require the jury to consider both aggravating factors and mitigating factors before determining that a death sentence is warranted. The Supreme Court has repeatedly acknowledged that some forms of mitigating evidence also might be construed as aggravating factors, particularly when biological and social predispositions are at issue. In these cases, testimony about neurological damage has the potential to be “at least as harmful as it [is] helpful,” since it may reflect on the defendant’s continuing dangerousness. Defense counsel cannot know beforehand whether the jury will find evidence of a defendant’s brain dysfunction to be pitiable, subjecting him unwillingly to impulses he eventually could not resist, or rather to frightening, evidence of a potentially incurable problem that renders him a continuing danger to society. Due to these complexities and the extensive Supreme Court precedent holding that

diagnosing other mental disorders. Of course, this objection also could be made generally as a reason to exclude neuroimaging findings when less potentially prejudicial evidence arguably would suffice.

54 Id.
56 See Brewer v. Quarterman, 127 S.Ct. 1706, 1711 (2007); see also Penry v. Lynaugh, 492 U.S. 302, 324 (1989) (characterizing the defendant’s mental disabilities and childhood abuse as a “two-edged sword” that “may diminish his blameworthiness for his crime even as it indicates that there is a probability that he will be dangerous in the future”).
58 See, e.g., Riley v. Cockrell, 215 F.Supp.2d 765, 777 (E.D.Tex. 2002) (finding defense counsel’s decision to forego presentation of evidence of defendant’s organic brain damage and mental deficiency was reasonable, since counsel
“death is different,” this section of the article gives special extensive consideration to the issues surrounding the use of neuroimaging in capital sentencing decisions.

The use of neuroimaging in the courtroom does not have to be an all-or-nothing proposition. The constitutional protections afforded to the defendant, as well as the degree of mental impairment required to merit differential treatment, vary throughout the different phases of a trial. Thus, the courts acknowledge that some offenders could “know the difference between right and wrong” and be competent to stand trial, but still have mental impairments which, though they “do not warrant an exemption from criminal sanctions… do diminish their personal culpability.” Neuroimaging technology may be appropriate at the stages of a case where evidentiary standards are more lenient and where concerns about possible abuse or disregard of the due process rights of the mentally ill are high, but not appropriate where the criteria for admissibility are strict and the potential for misunderstanding or misuse of the technology overwhelms the possible benefits.

Briefly, then, this article finds that neuroimaging evidence that passes the basic reliability and relevance requirements should almost always be allowed as a mitigating factor during sentencing proceedings. To the extent that such evidence reasonably informs the testifying expert’s diagnosis and the opportunity for adequate cross-examination exists, it should be permissible in competency hearings as well. Finally, courts should be most cautious when counsel wants to submit neuroimaging evidence to the jury to dispute mens rea charges or in support of an affirmative insanity defense. While neuroimaging should not be categorically excluded from the “guilt or innocence” phase of all criminal cases, the trial judge must carefully assess the particular circumstances of its use, including the probative value of the data, the availability of competent rebuttal witnesses, the opportunity for thorough cross-examination, and any related local procedural rules or case law limiting psychiatric testimony or the types of defenses that may be asserted. Ultimately, the appropriate boundaries for neuroimaging evidence during the case-in-chief should be a matter of judicial discretion, the same as any other controversial type of evidence would be.

1. Competency Determinations
This section of the article deals with the use of neuroimaging techniques in determinations of competency. Competency to stand trial is the most prominent such determination, and the one for which judicial precedent and dicta provide the most guidance. However, because “[t]he Due Process Clause does not mandate different standards of competency at various stages of or for different decisions made during the criminal proceedings,” the procedures and standards used to decide whether the defendant is cognitively

believed that the jury might use it to find defendant posed a future danger to society) (citing Motley v. Collins, 18 F.3d 1223, 1227-28 (5th Cir.), cert. denied, 513 U.S. 960 (1994)).

59 “This especial concern [with heightened standards for the fact-finding process in capital cases] is a natural consequence of the knowledge that execution is the most irremediable and unfathomable of penalties; that death is different.” Ford v. Wainwright, 477 U.S. 399, 411 (1986) (citing Woodson v. North Carolina, 428 U.S. 280, 305 (1976)).

60 Atkins v. Virginia, 536 U.S. 304, 318 (2002). This statement appeared in Atkins in the context of a discussion of the ways in which the diminished capacities of a mentally retarded individual affects his ability to understand and participate in his trial. Parallel “diminished capacity” arguments could be made for the mentally ill, depending on the nature of the disorder.

capable to be tried in a criminal case should also apply to decisions about competency to waive rights, submit guilty pleas, participate in sentencing hearings, and so forth. An extensive history of common law further buttresses the proposition that “a single standard, parallel to that articulated in Dusky v. U.S., is applied no matter what point during the legal proceedings a competency question should arise.” Thus, it is fair to assume throughout this section that, unless explicitly indicated otherwise, any discussions of competency determinations during a particular stage of the trial can be analogized to competency hearings more generally.

This aforementioned Dusky standard, which constitutes the requisite minimum standard for determining competency to stand trial, consists of a two part test: the defendant must have “sufficient present ability to consult with his lawyer with a reasonable degree of rational understanding,” and he must have “a rational as well as factual understanding of the proceedings against him.” This is a constitutionally mandated baseline, and states “are free to adopt competency standards that are more elaborate than the Dusky formation.” Due process also requires the same test—no more, no less—for determinations of competence to plead guilty or to waive one’s right to counsel. Since “the conviction of an accused person while he is legally incompetent violates due process,” and the failure to receive an adequate hearing on the issue of competence is grounds for reversal and a new trial, courts may be more amenable to allowing neuroimaging evidence at this stage if such evidence will strengthen their conclusions about a defendant’s current mental fitness.

This proposition is further bolstered by the distinction between, on the one hand, those due process rights that “require suspension of the criminal trial until such time, if any, that the defendant regains the capacity to participate in his defense,” and on the other, an asserted NGRI defense, which “presupposes that the defendant is competent to stand trial and to enter a plea” and the validity of which the States are under no confirmed constitutional requirement to recognize. It follows, then, that to the extent that neuroimaging evidence is at all probative of a defendant’s alleged incompetence, it should carry a heavier presumption of admissibility during a competency hearing than it would during the case-in-chief, since constitutional rights are more pointedly implicated during the former stage than the latter.

The legal basis for this contention, and the increasing deference given during competency hearings to reliable and relevant neuroimaging evidence and the testimony that it supports, is apparent in recent case law. For example, in State v. Marshall, the Washington state Supreme Court found that the trial court committed an abuse of discretion when it disregarded evidence of neurological dysfunction proffered by the defense to argue that the defendant was incompetent when he submitted a “guilty” plea against counsel’s advice. The defense expert witnesses had

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62 Id. at 405-08 (summarizing the historical treatment of competency in English and American common law).
63 Dusky v. United States, 362 U.S. 402 (1960); accord Drope v. Missouri, 420 U.S. 162, 171 (1975) (“[A] person whose mental condition is such that he lacks the capacity to understand the nature and object of the proceedings against him, to consult with counsel, and to assist in preparing his defense may not be subjected to a trial.”).
65 Id. at 399-401. The trial court must also find that waiver of these constitutional rights is “knowing and voluntary,” but this is a distinct inquiry from the competence question. Id. at 400-01.
67 Id. at 386-87.
68 Medina v. California, 505 U.S. 437, 448-49 (1992) (“[W]hile the Due Process Clause affords an incompetent defendant the right not to be tried, we have not said that the Constitution requires the states to recognize the insanity defense.” (internal citations omitted)).
69 144 Wash.2d 266, 280-81 (2001). The court noted that “[t]he competency standard for standing trial is the same as the standard required for pleading guilty.” Id. at 281.
determined that the defendant’s “organic brain disease and functional psychosis” interfered with his mental functioning in a way that prevented him from maintaining legal competence and from knowingly and intelligently waiving his rights. The experts supported this conclusion with a series of neuroimaging results: an MRI revealing atrophy in decision-making regions of the brain, an EEG showing slowed frequency of neurological electrical activity, and a SPECT scan demonstrating abnormal blood flow in the brain. This data and the diagnosis drawn therefrom were corroborated with intelligence testing, diagnostic interviews with the defendant, review of defendant’s medical history, and lay witness testimony from relatives who had witnessed physical abuse that may have contributed to the defendant’s brain trauma. Because this evidence indicated that the defendant was incompetent at the time the guilty plea was made, the Washington Supreme Court vacated the plea and remanded.

Those who would object to the use of neuroimaging tests as potentially inappropriate for competency determinations might derive their arguments from criticisms leveled at psychological testing in general as it is used and performed in the context of competency evaluations. Specifically, the Dusky competency test is articulated in terms of functional abilities, rather than clinical diagnostics, and if the relevant “capacities are present, lingering doubts about clinical issues such a differential diagnoses may not need to be resolved.” As a result, for instance, although a clinical diagnosis stemming from psychological testing can help evaluate the probability that the defendant is malingering—insofar as a defendant with genuine psychosis, mental retardation, or other mental ailment is, all else equal, more likely to lack the necessary capacities—it arguably constitutes an unnecessarily indirect manner of measuring the real construct of concern, which could be assessed in a manner less prone to distortion or interference. Similarly, while images of the structure of the brain may be of some assistance in proving that a particular defendant is not malingering, the existence of anatomical

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70 Id. at 276.
71 Id. at 273-74.
72 Id. at 279-80.
73 Id. at 281.
74 The Marshall court noted that “[f]ailure to observe procedures adequate to protect an accused’s right not to be tried while incompetent to stand trial is a denial of due process.” Id. at 279.
75 After describing the rationale for requiring that a criminal defendant be found competent, the Marshall court added that “[i]n a capital case there is a special need for reliability in the determination that death is the appropriate punishment.” Id. at 277 (internal quotations omitted).
77 See, e.g., id. at 48, tbl. 3.2 (listing twelve factors to be considered in using psychological assessment techniques as part of a forensic evaluation).
78 For instance, neuroimaging showing physical damage to the brain could support a diagnosis of organic amnesia stemming from a traumatic brain injury. Such evidence would be particularly useful given the ease with which a defendant could otherwise simply respond “I do not remember” to questions about the alleged crime. See James E. Tysse & Thomas L. Hafemeister, Amnesia and the Determination of Competency to Stand Trial, 25 DEV. IN MENTAL HEALTH L. 65, 76-77 (2006).
abnormalities is irrelevant in itself as long as the defendant displays sufficient cognitive capabilities to fulfill the *Dusky* requirements.

However, the objection that the defendant’s competency can be assessed through non-technological observation and testing, thus supposedly rendering neuroimaging data superfluous, is insufficient to justify excluding such neuroimaging evidence as a matter of policy. Indeed, the aforementioned purported shortcomings of traditional psychological testing suggest that an array of methodologies is probably the superior approach, such that their respective strengths might mitigate the others’ weaknesses, and consistent findings between the techniques might bolster the evaluators’ confidence in their conclusions. Certain federal district courts already have come to such an understanding in the context of competency determinations. In *United States v. Gigante*, for instance, the defendant moved for an order declaring him incompetent to undergo the sentencing proceedings, which the court determined required the same findings of fact and law that would be at stake under the *Dusky* “competency to stand trial” test.\(^79\) In support of their respective positions, “[e]xperts for both sides conducted or relied upon the appropriate brain scans, psychological tests, and interviews of defendant.”\(^80\) That is, the use of neuroimaging formed one component of a comprehensive analysis of the defendant’s cognitive capabilities. As a result, the court was able to acknowledge that all of the experts employing neuroimaging techniques in such a manner were “able, ethical, and candid… [and] all met the standards of *Daubert*.\(^81\) The various experts from both the prosecution and the defense in *Gigante* testified as to how they incorporated PET, SPECT, and CT scan data into their diagnoses and provided a scientific basis for explaining why they disagreed with the other side’s interpretations.\(^82\)

In crediting the prosecution’s argument that the defendant was malingering, the *Gigante* court did not imply a more general rejection of the methodology or use of neuroimaging itself. Rather, the opinion noted that while the proffered neuroimaging results may have demonstrated some low level of dementia, such a finding was inconsistent with other types of evidence submitted to the court and was not persuasive enough to overcome the suspicion that the defendant was feigning or exaggerating his symptoms.\(^83\) Indeed, it was the use of neuroimaging by the prosecution, rather than the defense, driving this conclusion; the court emphasized the report and testimony of a government witness who reviewed the PET, SPECT, and CT scans in the medical record and determined that the images were inconsistent with the symptoms that the defendant had presented in court and during psychiatric evaluations.\(^84\) Other courts similarly should be able to identify scientifically sound neuroimaging data, to credit or discredit the interpretations of such data by expert witnesses, and to otherwise consider neuroimaging evidence in the same way they would any other type of evidence when making competency determinations.

Opponents of neurolaw in criminal cases also might point out that if a state legislature determines that by restricting the use of neuroimaging during competency hearings, it can best meet its penological goals without unduly burdening the defendant’s constitutional rights, reviewing courts are likely to “exercise substantial deference” to the state’s “considerable


\(^{80}\) Id. at 201.

\(^{81}\) Id. at 199.

\(^{82}\) Id. at 204-07, 217-22.

\(^{83}\) Id. at 207.

\(^{84}\) Id. at 221-22 (“The clinical impression is that the inconsistencies in presentation when taken in sum, are more consistent with a studied picture of feigning in the service of an obvious secondary gain than with any neurological or psychiatric syndrome…. This clinical picture is strongly supported by the physiological data.”).
experts in matters of criminal procedure and the criminal process.” The fact that neuroimaging is a relatively novel technologic advancement, without grounding “in centuries of common-law tradition,” arguably further removes its availability to the defendant from the category of fundamental rights and practices that the courts are obligated to protect.

The response, of course, is that even if the use of neuroimaging techniques itself is not a historically based fundamental right, it should receive a heightened level of deference when employed to protect such rights. Supreme Court jurisprudence is highly suggestive that, in the context of competency determinations, the state should bear the risk that purportedly probative neuroimaging evidence will make the defendant appear less competent than he actually is. For an incompetent defendant who nevertheless is forced to stand trial and to try to make “myriad… decisions concerning the course of his defense” and the waiver of certain constitutional rights, “the consequences of an erroneous determination of competence are dire[,]… threaten[ing] a ‘fundamental component of our criminal justice system’—the basic fairness of the trial itself.” Relative to the defendant’s interest, then, “the injury to the State of the opposite error—a conclusion that the defendant is incompetent when he is in fact malingering—is modest.”

While a state’s expenditure of time and money is not meaningless, the substantive error of an unwarranted incompetency determination can be corrected in subsequent proceedings. Indeed, provided that the neuroimaging data are not given a disproportionate amount of weight in the court’s decision, such information could help to avoid such errors by supporting or clarifying claims of incompetence. Moreover, as research in the field continues to progress, new techniques continue to develop, and neuroscientists are able to become ever-more confident in the conclusions they draw from the sharper data available to them, the exclusion of such evidence will be increasingly incompatible with an allegedly incompetent defendant’s due process rights.

2. The Case-in-Chief Phase of Trial

There are two primary ways in which neuroimaging could become relevant during the case-in-chief phase of the trial: to negate mens rea, and to support an insanity defense. As will be further elaborated throughout this subsection, these are two distinct inquiries. Federal and state legislatures have defined certain crimes in a manner such that one element the prosecution must prove is that the defendant had a particular subjective state of mind (a “specific intent”) at

85 *Medina*, 505 U.S. at 445-46 (upholding a legislative decision to assign the burden to prove incompetence by preponderance of the evidence to defendants).
86 *Id.* at 446.
88 *Id.* (citing *Patterson v. New York*, 432 U.S. 197 (1977)).
89 *Cooper*, 517 U.S. at 365.
90 *Id.*
91 Justice Kennedy’s dissenting opinion in a case involving involuntary commitment and release proceedings for the formerly criminally insane identifies the distinction as follows: Mental illness may bear upon criminal responsibility, as a general rule, in either of two ways: First, it may preclude the formation of *mens rea*, if the disturbance is so profound that it prevents the defendant from forming the requisite intent as defined by state law; second, it may support an affirmative plea of legal insanity. Depending on the content of state law, the first possibility may implicate the State’s initial burden… to prove every element of the offense beyond a reasonable doubt, while the second possibility does not.

Despite the fact that proof of this mens rea element is dependent on the individual defendant’s mindset at the time of the crime, however, there is generally a presumption that he was thinking in the same way that an ordinary person would have thought under the same circumstances. Barring any legislative prohibitions against the following type of argument, then, a defendant could proffer neuroimaging data in an attempt to demonstrate that he lacked the brain structure or function or the cognitive capabilities necessary to form the requisite intent that the factfinder might otherwise infer from his actions. Of course, if the factfinder believed this evidence, it would be forced to exonerate him. One corollary concern is that subsequent civil commitment procedures (if initiated at all) would be insufficient to contain and control truly dangerous persons in the long-term, whose possible eventual release from psychiatric institutionalization would render them a continuing danger to society.

A plea of not guilty by reason of insanity (“NGRI”), in contrast, is an affirmative defense that contends that even if the prosecution is able to prove each element of the crime beyond a reasonable doubt, the defendant should be excused from culpability because a mental disease or defect rendered him unable to appreciate the consequences of his conduct or to conform his behavior to the requirements of the law. This section of the article considers each of the two possibilities—negating mens rea and NGRI pleas—separately, and also discusses more generally the potential benefits and drawbacks to using neuroimaging during the guilt phase of a trial.

a. Negating Mens Rea: As noted above, the evidentiary rules of some states “may allow a defendant to introduce (and a factfinder to consider) evidence of mental disease or incapacity for the bearing it can have on the government’s burden to show mens rea.” That is, the defendant is presumed innocent of the allegations against him until the government proves each element of the offense beyond a reasonable doubt, including the mental element of the crime. While the defendant is also presumed to be both sane and capable of forming the requisite mens rea, some

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92 The Model Penal Code, for instance, proposes a hierarchy of culpable states of mind: purposely, knowingly, recklessly, and negligently. The prosecution must prove that the defendant acted with one of these states of mind, as pre-defined for the particular law, with respect to each material element of the offense. Model Penal Code § 2.02.


94 Federal law, for instance, allows the affirmative defense that “at the time of the commission of the acts constituting the offense, the defendant, as a result of a severe mental disease or defect, was unable to appreciate the nature and quality or the wrongfulness of his acts.” 18 U.S.C. § 17(a). However, the statute adds that “[m]ental disease or defect does not otherwise constitute a defense.” Id. As federal district courts have construed it, the law “does not preclude a defendant from submitting mental health evidence for the purpose of rebutting the prosecution's proof of the mens rea element of a specific intent crime.” United States v. Dupre, 462 F.3d 131, 137 (2d Cir. 2006). But such attempts to negate mens rea are allowed only in the “rare and narrowly defined circumstances” where it would not constitute an argument of “diminished capacity, diminished responsibility, mitigation, [or] justification.” United States v. Sabir, 2007 WL 1373184, *5 (S.D.N.Y. 2007). Some states, moreover, completely prohibit evidence of mental illness and incapacity to rebut evidence of the requisite criminal intent; the Supreme Court has upheld this as a constitutional exercise of state power. Clark v. Arizona, 126 S.Ct. 2709, 2718 (2006).

95 For an interesting and thorough discussion of the intersection of criminal insanity, institutionalization, and culpability, see Sherry F. Colb, Insane Fear: The Discriminatory Category of “Mentally Ill and Dangerous,” 25 New Eng. J. On Crim. & CIV. Confinement 341 (1999). The Conclusion of this article further discusses the effect of neuroimaging on involuntary commitment proceedings.

96 See 22 C.J.S. Criminal Law § 132 (2007) for an overview of the various types of insanity tests promulgated by different jurisdictions.


98 Id. at 2729.
states allow defendants to proffer evidence rebutting these presumptions and relieving them of
guilt. In such jurisdictions, “the evidence of mental disease or incapacity need only support
what the factfinder regards as a reasonable doubt about the capacity to form (or the actual
formation of) the mens rea, in order to require acquittal of the charge.”

This suggests that some jurisdictions may need to exercise special caution when allowing
neuroimaging techniques into their courtrooms, depending on the policies and procedures
previously established to handle evidence of mental disease or defect that is intended to refute or
support mens rea claims. Specifically, results from a brain scan that even tentatively suggest a
connection between an anatomical abnormality and an inability to form the requisite mens rea
might be sufficient to raise a “reasonable doubt” in a juror’s mind. This, in turn, would make
proving the specific intent element of a charge a constant source of difficulty at trial, perhaps
forcing prosecutors to accept plea bargains with a lower level of criminal intent (“reckless”
instead of “intentional,” for example) or legislatures to rewrite criminal laws in order to
minimize the impact. In order to preempt such repercussions, courts may find it necessary to
strictly limit the use of neuroimaging technology in such jurisdictions.

Of course, the negative connotation of the word “repercussions” implies that it would be
undesirable for a defendant to be convicted of a lesser crime due to the availability of
neuroimaging evidence that is suggestive of a less culpable mental state at the time of the crime.
However, it is possible that such evidence actually helps to ensure that the ultimate legal
judgment properly aligns with the defendant’s moral culpability. That is, a jury might
reasonably believe that the existence of brain abnormalities beyond the defendant’s control does
not warrant a full acquittal, but does require conviction of a lesser charge. For instance, the jury
might be convinced that, rather than carrying out a premeditated first-degree murder, the
defendant’s brain rendered him more likely to commit an impulsive second-degree murder or
that he was reckless for not controlling his neurologically induced symptoms of aggression or
episodic dyscontrol.

In these circumstances, the criminal act still would be punished, but
under a charge and conviction that better accords with the legislature’s underlying intent in
defining crimes in a way that accounts for mens rea when assessing culpability.

Supreme Court precedent indicates that certain limitations on particular categories or
classifications of evidence can be constitutional, notwithstanding the presumption that a
defendant’s due process rights allow him to present all “evidence favorable to himself on an
element that must be proven to convict him,” including mens rea. Namely, this “right to
introduce relevant evidence can be curtailed if there is a good reason for doing [so],” pursuant
to the trial judge’s discretion, and provided that the rule under which it is excluded serves a
legitimate purposes and is proportionate to the ends it is asserted to promote. Moreover, this

99 Id. at 2730.
100 Id. at 2730-31.
101 Tellingly, emerging research suggests that different types of murderers display different neurological patterns.
For example, impulsively violent murderers show reduced metabolic activity in the frontal region of their brains (an
area associated with planning complex behavior and moderating social responses) whereas the frontal regions of
murderers whose killings were carefully planned and executed tend to be intact. See Daniel Strueber et al., The
murderers using PET scan technology).
102 Clark, 126 S.Ct. at 2731 (discussing evidence that tended to show defendant’s prior mental disease, which
potentially reflected his capacity to form the required mens rea of the crime).
103 Id.
104 Id. at 2731-32 (citing Holmes v. South Carolina, 126 S.Ct. 1727, 1732 (2006)).
proposition holds true even where the restricted evidence is admissible for other purpose; thus, a court could allow the defense team to utilize neuroimaging data during certain phases of the trial or to support limited defense assertions, but could otherwise restrict its use, including particularly by refusing to allow its admission to negate mens rea. The relevant constitutional question is then whether the “reasons for requiring it to be channeled and restricted are good enough to satisfy the standard of fundamental fairness that due process requires.”

The U.S. Supreme Court’s treatment of mental health evidence suggests that a legislative or judicial judgment restricting or “channeling” neuroimaging evidence would comport with this standard. The “characteristics of mental-disease and capacity evidence” in general, which give rise to “risks that may reasonably hedged by channeling the consideration of such evidence” to limited issues, are applicable and analogous to the characteristics of and risks stemming from the use of neuroimaging in particular. The Court has identified three concerns regarding the use of mental health evidence broadly construed: controversy within the psychiatric profession about the nature and diagnosis of the illness itself; the power of such evidence to mislead jurors into believing that the existence of a mental disease or defect necessarily signifies a lack of cognitive, moral, or volitional capacity; and the risk of jurors affording expert testimony about the defendant’s mental state at the time of the crime more weight or credibility than it deserves. Similarly, opponents of the use of neuroimaging evidence might argue that interpretation of a brain scan is a subjective process whereby different doctors may come to sharply divergent conclusions, which conclusions themselves may need to be revised as the field of neuroscience advances; that the presentation of blips on a brain scan may hold undue influence over some jurors, convincing them that the appearance of a minor neurological abnormality diminishes the defendant’s self-control and hence culpability when such a finding is unwarranted; and that experts whose testimony incorporates neuroimaging data will be disproportionately influential compared to experts who derive their diagnoses by utilizing other types of testing, because the opinions of the former seemingly have the imprimatur of “Science.” As the Supreme Court recognized in Clark v. Arizona, although jurisdictions may differ in their respective assessments of the value of allowing the use of neuroimaging (or any other type of mental health evidence) to support or oppose insanity or mens rea determinations, there are sufficient “sensible reasons to assign the risks… by channeling the evidence,” and a state that chooses to require its courts to do so will not violate the demands of due process or any fundamental principles of justice.

b. The Insanity Defense: Neuroimaging evidence might also be employed during the case-in-chief phase of the trial as a component of the affirmative defense of insanity. As explained in the preceding subsection, evidence demonstrating that the defendant did not have

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105 Clark, 126 S.Ct. at 2732 (holding that if a trial court is allowed keep out certain evidence entirely, it may also choose to subject such evidence to limitations).
106 Id.
107 Id. at 2743.
108 Id. (“New knowledge generated by research or clinical experience will undoubtedly lead to an increased understanding of [psychiatric] disorders… and to the identification of new disorders” (quoting AM. PSYCHIATRIC ASS’N, DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS xxxiii (4th ed. text rev.2000))).
109 Clark, 126 S.Ct. at 2734-35 (“It is very easy to slide from evidence that an individual with a professionally recognized mental disease is very different, into doubting that he has the capacity to form mens rea, whereas that doubt may not be justified.”).
110 Id. at 2735-36 (“[E]mpirical and conceptual problems add up to a real risk that an expert’s judgment… will come with an apparent authority that psychologists and psychiatrists do not claim to have.”).
111 Id. at 2737.
the requisite mens rea at the time of the crime necessitates a finding of “not guilty,” since the prosecution is required to prove all elements of the offense beyond a reasonable doubt.\footnote{Id. at 2729 (“The first presumption is that a defendant is innocent unless and until the government proves beyond a reasonable doubt each element of the offense charged, including the mental element or mens rea.” (internal citations omitted)).} In contrast, insanity at the time of the crime can \textit{excuse} the defendant from his criminal behavior, even if all of the elements of the offense, including mens rea, have been established.

The traditional standard for sustaining an NGRI plea is derived from the holding of \textit{M’Naghten’s Case},\footnote{10 Cl. & Fin. 200, 8 Eng. Rep. 718 (1843).} which allows a defendant to demonstrate that a mental defect renders him deficient in either cognitive capacity (the ability to understand what he was doing) or moral capacity (the ability to appreciate the wrongness of his conduct).\footnote{Clark, 126 S.Ct. at 2718-19.} Since then, jurisdictions throughout the United States have implemented a number of variations of the \textit{M’Naghten} test for insanity, although a few states do not provide for any affirmative insanity defense at all.\footnote{Id. at 2719-20. The opinion describes two other prevalent standards: The irresistible-impulse test, which asks whether the defendant was so lacking in volition that he could not have controlled his actions, and the aptly named “product of a mental illness” test, which asks if the defendant’s alleged criminal behavior was the product of a mental illness. \textit{Id.} at 2720.} Moreover, in addition to the ability of a state to maintain narrow and strictly construed standards for establishing exculpatory insanity or to preclude use of the defense completely, the state also may “limit… which sorts of mental illness or defect can give rise to a successful insanity defense.”\footnote{Id. at 2720, n.11.}

Clearly, then, the Supreme Court sees a distinction between a defendant’s right to present mitigating evidence in capital punishment decisions, which is grounded in the Eighth and Fourteenth Amendments,\footnote{Lockett \textit{v.} Ohio, 438 U.S. 586, 604 (1978).} and his ability to present an insanity defense, which has no such unequivocal constitutional or historical foundation.\footnote{Clark, 126 S.Ct. at 2719 (“History shows no deference to \textit{M’Naghten} that could elevate its formula to the level of fundamental principle, so as to limit the traditional recognition of a State’s capacity to define crimes and defenses.”). Note, however, that \textit{Clark} does not definitively deny such a foundation either: “We have never held that the Constitution mandates an insanity defense, nor have we held that the Constitution does not so require.” \textit{Id.} at 2722.} While this does not completely foreclose the possibility of a court allowing a defendant to present any and all potentially relevant neuroimaging data in support of an insanity defense, it does indicate that before doing so during the phase of the trial establishing guilt or innocence, the judge should give special weight to the general considerations involved with the use of this technology.

For example, one reason for disallowing neuroimaging results to support NGRI pleas or to refute specific intent is that, even though a defendant cannot “fake” a brain scan in the way he could mangle during a psychiatric interview, there are other ways that the test results could mislead a jury. For instance, minor anomalies that appear on a brain scan may not cause cognitive and behavioral issues as severe as the defense would like the factfinder to believe; the defendant’s behavior, either at the time of the crime or at trial, may be inconsistent with what the abnormality would seem to suggest; with knowledge of the existence of some physical evidence of brain dysfunction, the defendant may grossly exaggerate his symptoms to try to bolster the plausibility of his NGRI claim; and, especially when there is a long time lag between the commission of the crime (the relevant time with respect to the defendant’s sanity) and the trial (the time at which measurement of the defendant’s brain occurs), the condition of the
defendant’s brain may have deteriorated. Of course, to the extent that a defense team incorporates multiple types or iterations of neuroimaging testing into its evidentiary presentation, or if the prosecution undertakes a neurological assessment of the defendant independently, prosecutorial rebuttal of such evidence could capitalize on any inconsistencies between test results, highlight ambiguous or arguably contradictory results produced by two different types of neuroimaging scans, or argue that a neuroimaging scan predicts cognitive behaviors and capacities that are not born out by objective psychological testing. Moreover, given these inherent shortcomings of neuroimaging, the proponent may be forced to make an initial showing that this type of evidence meets basic admissibility standards of reliability and relevance.

To elaborate on one especially potent difficulty with the presentation of neuroimaging evidence during the guilt phase of a criminal trial, as suggested above, neuroimaging results demonstrate the condition of the defendant’s brain at the time the test was performed, whereas the insanity defense focuses on the defendant’s state of mind at the time the crime was committed. In the interim, the structure and functioning of the defendant’s brain could have worsened, whether due to new trauma, drug and alcohol use, or natural deterioration. The defendant may not disclose trauma or substance abuse that occurred subsequent to the commission of the crime, making it impossible to accurately gauge the extent of any change in condition during the period between the crime at issue and the neurological test. As the length of this lag time increases, so too does the likelihood that any organic changes in the brain will be substantial.

This suggest that while such data should be helpful in assessing a defendant’s current competence to stand trial, it will be less informative about his mental state in the distant past. On the other hand, insanity defenses often incorporate the expert testimony of forensic psychiatrists or psychologists, whose evaluations of the defendant’s mental state at the time of the crime are based on more recent interviews with the defendant (and perhaps his family, colleagues, and acquaintances) about his past and present behavior. Both a history of mental illness and a currently diagnosed mental illness are considered highly suggestive of mental illness at the time of the crime. Likewise, then—and regardless of any brain images that may already be in the defendant’s medical record—the presentation of neuroimages taken as part of an insanity defense assessment could support an NGRI verdict without being dispositive proof thereof. The prosecution would be able to challenge the validity and relevance of the findings on cross-examination, particularly if the defendant’s medical and psychological records were inconsistent with the most recent data offered at trial.

3. Sentencing

119 A growing number of studies demonstrating the neuroplasticity of the brain provide an interesting counterpoint to the possibility of neurological degeneration subsequent to the crime. Neuroplasticity refers to the ability of even adult brains to continue to develop and change in response to both external and internal stimuli. Thus, in theory, the structure and function of a defendant’s brain could have improved from the time of the crime, particularly if the defendant has stopped abusing controlled substances or undertakes an extended course of cognitive therapy. See Sharon Begley, How The Brain Rewires Itself, TIME (Jan. 19, 2007), available at http://www.time.com/time/printout/0,8816,1580438,00.html (reviewing several studies that showed how life experiences and cognitive training can alter the physiology of the brain, including in the context of adult psychiatric disorders); see also Matthew Blakeslee, Reviews: Rewiring the Brain, DISCOVER (Mar. 29, 2007), available at http://discovermagazine.com/2007/mar/rewiring-the-brain (reviewing two recently released books that explore the science behind taking advantage of the brain’s neuroplasticity to treat senility, post-traumatic stress, depression, and other disorders).
As noted above, researchers acknowledge that even when the statistical associations between anatomy and action are strongest, environmental factors likely play a role in turning neurological predispositions into criminal behavior. Those who oppose bringing neuroscience into the courtroom may attempt to capitalize on this perceived limitation by claiming that the ambiguity over which of “nature” or “nurture” drives an individual to act (as if the two were mutually exclusive) renders such neuroimaging evidence inappropriate, unhelpful, or even dangerously deceptive. This argument loses its force in the context of sentencing decisions, however, given that juries are often permitted by statute to consider environmental factors such as childhood abuse, lack of education, and poverty, as mitigating circumstances, even without additional evidence tending to show that these factors directly affected the defendant’s mind and thus culpability. In considering the application of neuroimaging during the sentencing phase of the trial, therefore, this section of the article maintains that the burden should be on the detractors of neurolaw to demonstrate why courts should impose additional or different burdens on the use of neuroimaging evidence. This section explains why the presumption of admissibility is especially powerful when the death penalty is a possibility and due process considerations require that sentencing guidelines be broadly construed to allow virtually anything with potentially mitigating value into the record. Indeed, because judicial opinions for capital sentencing cases present the relevant constitutional considerations with more clarity, detail, and vigor than for any other crime, these decisions form the bulk of the basis for analysis in this section. However, this article finds that because the underlying issues are closely analogous, the rationale for permitting broad use of neuroimaging in death penalty decisions applies to sentencing hearings for other types of criminal convictions as well.

a. **Sentencing Procedures:** Although not constitutionally mandated, Supreme Court case law and historical precedent support “the concept of individualized sentencing in criminal cases generally,” including judicial discretion to consider a “wide range” of potentially mitigating factors. This general endorsement of personalized decisions becomes a constitutional mandate under the Eighth and Fourteenth Amendments, however, when capital punishment is considered. Since “the imposition of death by public authority is so profoundly different from all other penalties,” the Supreme Court emphasizes the imperative that the sentencer “not be precluded from considering, as a mitigating factor, any aspect of a defendant’s character or record and any of the circumstances of the offense that the defendant proffers as a basis for a sentence less than death.” Thus, “a statute that prevents the sentencer in all capital cases from giving independent mitigating weight to aspects of the defendant’s character and record… creates the risk that the death penalty will be imposed in spite of factors which may call for a less severe penalty,” which in turn renders such a statutory proscription “unacceptable and

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120 See, e.g., Eddings v. Oklahoma, 455 U.S. 104 (1982) (finding the Eighth and Fourteenth Amendments to be violated in capital cases when the sentencer is precluded from considering any aspect of defendant’s character or record that may be mitigating, which in this particular case included an unhappy upbringing and emotional disturbance).

121 Lockett v. Ohio, 438 U.S. 586, 602-03 (1978) (“P]ossession of the fullest information possible concerning the defendant’s life and characteristics is highly relevant – if not essential – to the selection of an appropriate sentence.” (citations and quotations omitted)).

122 Id. at 604; see also Woodson v. North Carolina, 428 U.S. 280, 304-05 (1976) (plurality opinion) (“T]he fundamental respect for humanity underlying the Eighth Amendment… requires consideration of the character and record of the individual offender… as a constitutionally indispensable part of the process of inflicting the penalty of death.”).

123 Woodson, 428 U.S. at 605.

124 Id. at 604 (emphasis in original).
incompatible with the commands of the Eighth and Fourteenth Amendments.” Accordingly, a blanket prohibition on the use of neuroimaging evidence would be constitutionally suspect in any criminal sentencing guidelines, and especially in those cases where the possibility of capital punishment is involved.

The laws of the various states often allow the prosecution to present as a statutory aggravating factor evidence of a probability that the defendant will commit future acts of violence constituting a continuing threat to society. \(^{126}\) \textit{Barefoot v. Estelle} upheld the use of psychiatric testimony to establish future dangerousness, notwithstanding arguments that it was too difficult to predict. \(^{127}\) The Court’s emphasis that the jury must be able to weigh all possibly relevant information suggests that in the event a defense team submits neuroimaging evidence indicative of a defendant’s intractable predisposition toward criminal violence for which such defendant purportedly should not be held morally culpable, the prosecution could respond that this same evidence should be considered an aggravating circumstance (i.e., an uncontrollable future dangerousness) as much as a mitigating one. In states where the death penalty is prohibited if the statutory mitigating factor of impaired mental capacity exists, defense counsel may not be overly preoccupied with the risk that the jury will interpret their client’s brain dysfunction as an aggravating factor, as long as they believe that the jury must concede that it also “significantly impaired” the defendant’s cognitive capabilities and self-control. \(^{128}\) In contrast, in jurisdictions where the sentencer must balance the factors on both sides, defense counsel might reason that the best course of action is to try to ensure that neuroimaging evidence is completely left out of sentencing considerations. \(^{129}\)

Meanwhile, at the federal level and for crimes other than capital murder, Congress passed sentencing guidelines that stated that the defendant’s future dangerousness and mental capacity should be considered (among other factors) as aggravating or mitigating circumstances that would extend or reduce the length of the sentence imposed in a particular case from a certain statutorily defined baseline level. \(^{130}\) However, following the Supreme Court decision in \textit{United States v. Booker} \(^{131}\)—which protects a defendant’s Sixth Amendment right to a trial by jury when the judge otherwise would be able to increase the length of such defendant’s sentence based on findings of facts beyond those which either the defendant’s conviction or his own admissions

\(^{125}\) \textit{Id.} at 606.

\(^{126}\) \textit{See, e.g.,} VA. CODE ANN. § 19.2-264.2 (“[A] sentence of death shall not be imposed unless the court or jury shall (1) after consideration of the past criminal record of convictions of the defendant, find that there is a probability that the defendant would commit criminal acts of violence that would constitute a continuing serious threat to society….”).

\(^{127}\) 463 U.S. 880, 901 (1983) (“All of these professional doubts about the usefulness of psychiatric predictions can be called to the attention of the jury…. [Objections to such testimony are] founded on the premise that a jury will not be able to separate the wheat from the chaff. We do not share in this low evaluation of the adversary process.”).

\(^{128}\) For example, while generally the sentencer in Connecticut must weigh mitigating and aggravating factors before recommending death, capital punishment is flatly prohibited if any one of several statutorily delineated mitigating factors exists. Among these is the finding by special verdict that “the defendant's mental capacity was significantly impaired or the defendant's ability to conform the defendant's conduct to the requirements of law was significantly impaired but not so impaired in either case as to constitute a defense to prosecution.” C.G.S.A. § 53a-46a(h)(3).

\(^{129}\) \textit{See, e.g.,} K.S.A. § 21-4624(e) (authorizing a death sentence if the jury unanimously finds the existence of one or more enumerated aggravating circumstances, which are not outweighed by any mitigating circumstances that might be found to exist).


would support—these guidelines are to be treated as advisory rather than mandatory.\(^\text{132}\) This change neither precludes nor requires a trial judge to incorporate proffered neuroimaging data into the sentencing proceedings; indeed, in accordance with the principle of treating these guidelines as advisory, the judge has the discretion to determine whether such consideration is appropriate for the sentencer given the particular circumstances of each case.

b. **Sentencing Policies:** The Supreme Court has held that certain classes of offenders—particularly, the mentally retarded\(^\text{133}\) and youth under age eighteen\(^\text{134}\)—are not appropriate candidates for capital punishment because their developmental and behavioral characteristics render their level of moral culpability less than that of an average adult, even when they commit otherwise equivalent crimes.\(^\text{135}\) These decisions emphasize that the death penalty “must be limited to those offenders who commit ‘a narrow category of the most serious crimes’ and whose extreme culpability makes them ‘the most deserving of execution.’”\(^\text{136}\) Thus, given the Supreme Court’s desire to restrict the imposition of capital punishment to the most heinous criminals, and to the extent that an individual’s neurological damage or dysfunction reduces his cognitive capacity to control or appreciate the consequences of his conduct, neuroimaging can assist the factfinder in determining whether the infliction of a death sentence conforms with legal and societal expectations in a particular case.

The prohibition against the execution of those who are insane at the time the sentence is to be carried out is founded primarily on a different rationale. The reduced moral culpability of juveniles and the mentally retarded is based on their relatively limited intellectual capacities at the time the crime was committed. In contrast, the mentally insane death row inmate was (presumably, given that he was convicted of capital murder despite any asserted NGRI defense) fully cognizant of the moral implications and factual consequences of his actions when he committed the murder. He is spared capital punishment only because society believes that all people are due “the opportunity to prepare, mentally and spiritually, for their death,” and because the retributive justification for the penalty “depends on the defendant’s awareness of the penalty’s existence and purpose.”\(^\text{137}\) If the defendant regains his sanity, such concerns no longer apply and any stay of execution on grounds of incompetence will be lifted.\(^\text{138}\) Thus, neuroimaging could be used by the defense in a capital case first as a mitigating factor during the determination of whether a capital sentence is justified, and later as proof that the individual is insane and the death sentence should not be carried out. The former arguments would be focused on the defendant’s mind and culpability at the time the crime was committed, whereas the latter would be concerned with the defendant’s condition at the time of the punishment itself.

The Supreme Court understands the death penalty to serve two penological goals, with “retribution” being the first and “deterrence of capital crimes by prospective offenders” being the

\(^{132}\) Id. at 244.


\(^{134}\) Roper v. Simmons, 543 U.S. 551 (2005).

\(^{135}\) See Atkins, 536 U.S. at 306 (“Because of their disabilities in areas of reasoning, judgment, and control of their impulses… [the mentally retarded] do not act with the level of moral culpability that characterizes the most serious adult criminal conduct.”); Roper, 543 U.S. at 569 (“[J]uvenile offenders cannot with reliability be classified among the worst offenders… [because of their] lack of maturity and an underdeveloped sense of responsibility…, qualities [that] often result in impetuous and ill-considered actions and decisions.” (internal citations and quotations omitted)).

\(^{136}\) Roper, 543 U.S. at 568 (citing Atkins, 536 U.S. at 319).


\(^{138}\) Id. at 425 n.5.
second. Imposition of the penalty is an “unconstitutional” infliction of “purposeless and needless... pain and suffering,” unless it “measurably contributes to one or both of these goals.” Thus, the courts must be cautious about ensuring that defendants are allowed a full opportunity “to make a persuasive showing of mitigation in the face of prosecutoriual evidence of one or more aggravating factors.” Neuroimaging evidence, in turn, could help a defendant demonstrate why neither the retributive nor the deterrence goals of capital punishment would be served in his particular case. Such arguments, moreover, are most likely to be appropriate in this death penalty context, given the greater judicial leniency regarding admissibility of evidence compared to other stages of the trial.

More specifically, under the retributive theory, “the severity of the punishment necessarily depends on the culpability of the offender.” Structural and functional abnormalities within a defendant’s brain could be linked to characteristics and behaviors that distinguish him from the most depraved killers for whom the ultimate punishment of death is reserved. Similarly, the deterrent effect of the death penalty is thought to be limited to those murders that are the result of premeditation and deliberation. A defendant who can prove that his cognitive impairments have affected his ability to “understand and process information, to learn from experience, ... or to control impulses,” will fall into the category of those persons who are least likely to “process the information of the possibility of execution as a penalty, and, as a result, control their conduct based upon that information.”

c. Constitutional Rights: The Eighth Amendment and its practical interpretations structure much of the Supreme Court jurisprudence regarding capital punishment. The Court reads the Eighth Amendment as a constitutional prohibition of “all excessive punishments, as well as cruel and unusual punishments that may or may not be excessive.” As society’s understanding of the human condition grows and evolves over time, so too must the conception of “excessive” and “cruel” sanctions change to conform to currently prevailing norms. Also found to be implicit in the demands of the Eighth Amendment is a proportionality requirement, such that a punishment must be commensurate with the nature and severity of its underlying offense. Therefore, if neuroscience increasingly informs society’s factual and moral understanding of criminal behavior, then it follows that neuroscientific data should be incorporated into sentencing decisions under the Eighth Amendment.

Indeed, there is indication from the Supreme Court itself that a shift toward welcoming neuroscience evidence into the courtroom has already taken place. In Roper v. Simmons, the Supreme Court received an amicus brief from the American Medical Association and other scientific and neurological groups, the substance of which made reference to the greater activity

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139 Atkins, 536 U.S. at 319 (quoting Gregg v. Georgia, 428 U.S. 153, 183 (1976); see also Roper, 543 U.S. at 571-72 (discussing the two purposes of capital punishment in the context of persons under age eighteen).
140 Atkins, 536 U.S. at 319 (citing Enmund v. Florida, 458 U.S. 798, 798 (1982)).
141 Atkins, 536 U.S. at 320.
142 Id. at 319.
143 Id. (citing Enmund, 458 U.S. at 799).
144 Atkins, 536 U.S. at 320.
145 The text of the Eighth Amendment provides that “[e]xcessive bail shall not be required, nor excessive fines imposed, nor cruel and unusual punishments inflicted.” U.S. CONST. amend. VIII.
146 Atkins, 536 U.S. at 311 n.7.
147 Id. at 311-12 (“The Amendment must draw its meaning from the evolving standards of decency that mark the progress of a maturing society.” (citing Trop v. Dulles, 356 U.S. 86, 100-01 (1958))).
148 Atkins, 536 U.S. at 311-12; see also Weens v. United States, 217 U.S. 349, 367 (1910).
in the amygdala (connected to primitive emotions like aggression) in adolescent decision-making and to the delayed maturation of the prefrontal cortex (an area associated with impulse control and moral reasoning) to bolster their argument in favor of abolishing the death penalty for crimes committed when the defendant was under age eighteen. The Roper majority opinion then made explicit reference to “scientific and sociological studies” that demonstrate the developmental immaturity of the juvenile brain, in support of the proposition that minors are less morally culpable for their antisocial and criminal activities than adults. Both advocates and critics of neurolaw have interpreted this allusion as judicial endorsement of the AMA’s neuroscience-based argument.

Indeed, when capital punishment is a possibility, a statutory prohibition on the use of neuroimaging data as mitigating evidence during the sentencing phase of the trial might be an unconstitutional exercise of legislative power. Two recent U.S. Supreme Court companion cases out of Texas attest to the proposition that defendants must be given wide latitude to present to the sentencing court any number of extenuating circumstances—whether social, personal, or biological—that suggest reduced moral culpability for the offense committed. Extensive historical precedent has established, and recent Supreme Court opinions have confirmed, that a defendant’s rights are violated “whenever a statute, or a judicial gloss on a statute, prevents a jury from giving meaningful effect to mitigating evidence that may justify the imposition of a life sentence rather than a death sentence.” The Court has repeatedly “endorsed and broadened” a rule first articulated in Lockett v. Ohio that holds that “the sentencer in capital cases must be permitted to consider any relevant mitigating factor” in arriving at its decision.

d. Competency to Undergo Sentencing: The Eighth Amendment “has been recognized to affect significantly both the procedural and the substantive aspects of the death penalty.” This article has demonstrated that it is reasonable to anticipate that Eighth Amendment jurisprudence will influence the defendant’s right to use neuroimaging evidence during the sentencing phase of a capital punishment case as a potentially mitigating factor. Even after a sentence of death has been delivered, however, neuroimaging evidence may be relevant to ensuring that the death row prisoner has not subsequently fallen into the category of persons on whom “the Constitution places a substantive restriction on the State’s power” to execute—specifically, the legally insane. Indeed, while impressing on the lower courts the constitutional mandate to maintain adequate procedural safeguards to prevent the death sentences from being carried out on prisoners who have become mentally incompetent since the time of sentencing, the Court reasoned as follows:

If the Constitution renders the fact or timing of [the defendant’s] execution contingent upon establishment of a further fact, then that fact must be determined with the high regard for truth that befits a decision affecting the life or death of a

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151 Roper, 543 U.S. at 569.
152 See, e.g., Rosen, supra note 4 (claiming that parties on both sides of the debate have viewed the opinion “as the Brown v. Board of Education of neurolaw”).
158 Ford, 477 U.S. at 405.
human being. Thus, the ascertainment of a prisoner’s sanity as a predicate to lawful execution calls for no less stringent standards than those demanded in any other aspect of a capital proceeding. Indeed, a particularly acute need for guarding against error inheres in a determination that “in the present state of the mental sciences is at best a hazardous guess however conscientious.”

This rationale is telling for two reasons. First, it suggests that if this article is correct in its argument that neuroimaging can assist the factfinder in gauging a defendant’s mental status and thus moral culpability in mitigation proceedings, it should be all the more reliable in assessing a defendant’s present cognitive condition. Second, the Court seems to acknowledge that evaluating a prisoner’s sanity is an inherently imperfect process; it logically follows that, provided the additional data is based in sound scientific principles, more information will help to confirm or refute conclusions drawn from a process that may be prone to errors.

The proposition that determinations of competency to receive the death penalty may be informed by neuroimaging results is further implied by the analysis in Ford v. Wainwright of the shortcomings of Florida’s evaluation procedures for competency to undergo sentencing. First, after noting that in “all other proceedings leading to the execution of an accused” the defendant must be allowed to submit “all possible relevant information” to the factfinder, the Court concluded that “any procedure that precludes the prisoner or his counsel from presenting material relevant to his sanity or bars consideration of that material by the factfinder is necessarily inadequate.” This directly supports the assertion that neuroimaging data that is admissible in mitigation or other prior proceedings also can help the factfinder in post-sentencing competency evaluations in capital punishment cases.

The Ford opinion then emphasized “the value to be derived from a factfinder’s consideration of differing psychiatric opinions when resolving contested issues of mental state.” Invoking recent precedent that underscored the importance of the adversarial process when a criminal defendant’s sanity is at issue, the Court reasoned that since “psychiatrists disagree widely and frequently on what constitutes mental illness and on the appropriate diagnosis to be attached to given behavior and symptoms,” the factfinder must have “the substantial benefit of potentially probative information” when resolving mental health issues.

Rather than confusing the jury, the Supreme Court believes that presentation of conflicting testimony will reduce the likelihood of an erroneous decision. The opportunity for adequate cross-examination is essential, however, as it will bring to light “the bases for each expert’s beliefs, the precise factors underlying those beliefs, any history of error or caprice of the examiner, … [and] the expert’s degree of certainty about his or her own conclusions.”

Thus, as long as the evidence meets the basic admissibility threshold of scientific reliability and relevance, and as long as opposing counsel has the opportunity to question defense experts who

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159 Id. at 411-12 (quoting Solesbee v. Balkcom, 399 U.S. 9, 23 (1950) (Frankfurter, J., dissenting)).
160 Ford, 477 U.S. at 413.
161 Id. at 414.
162 Id.
163 Id. (quoting Ake v. Oklahoma, 470 U.S. 68, 81 (1985)).
164 Ford, 477 U.S. at 414.
165 Id.
166 Id. at 415. The opinion elaborated: “The stakes are high, and the ‘evidence’ will always be imprecise. It is all the more important that the adversary presentation of relevant information be as unrestricted as possible.” Id., 477 U.S. at 417.
wish to use it, neuroimaging technology will contribute to the truth-seeking process and should not be excluded simply because it is new or controversial.

e. Criticisms of Neuroimaging at Sentencing: In the past, some Justices have expressed concern about what they perceive to be an overly liberal understanding of what the Fifth, Eighth, and Fourteenth Amendments require with respect to mitigating evidence in capital cases:

If a defendant, as a matter of constitutional law, is to be permitted to offer as evidence in the sentencing hearing any fact, however bizarre, which he wishes, even though the most sympathetically disposed trial judge could conceive of no basis upon which the jury might take it into account in imposing a sentence, the new constitutional doctrine will not eliminate arbitrariness or freakishness in the imposition of sentences, but will codify and institutionalize it.  

To the extent that it is probative of the defendant’s mental condition, neuroimaging will not constitute the type of “bizarre” or irrelevant evidence about which Justice Rehnquist (to whom the above statement is attributable) expressed concerned.  However, since a comprehensive understanding of neuroscience typically is not within the common knowledge of the average citizen, there will remain the chance that unscrupulous experts could present what are minor and clinically insignificant neurological abnormalities in a defendant’s brain and try to link them to such defendant’s criminal behavior.  Accordingly, the procedural controls that will moderate potential abuses of such evidence must be addressed.

First, the prosecution is able to introduce its own expert witnesses to counter the defense experts’ testimony by offering different interpretations of proffered brain scans, providing alternative explanations for the results, and otherwise explaining why defense witnesses’ claims are debatable, if not scientifically unsound.  It then becomes a jury question as to which side’s position is more credible.  Moreover, while the threshold for admissibility is lower in sentencing decisions than it is during the course of the trial, the judge still has the ability to exclude expert assertions that are particularly egregious deviations from acceptable medical and scientific reasoning.  Whether the evidence comes from the prosecution or the defense, then, as long as the court is “not persuaded that such testimony is almost entirely unreliable,” it should trust “that the fact-finder and the adversary system will…be competent to uncover, recognize, and take due account of its shortcomings.”

Furthermore, images of the defendant’s brain that pass the initial threshold of admissibility—say, for instance, because certain anomalies appearing on them are statistically correlated with impulsive behavior or with a particular mental illness—will be discounted by the jury if counsel is unable to support the asserted connection with evidence that is specific to the defendant himself.  That is, the defense team will need to corroborate neuroimaging findings with clinical interviews, psychological testing, medical records, and lay testimony from family, friends, and colleagues who have interacted with the defendant over an extended period of time.  If the defense is unable to provide such individualized documentation, it renders itself vulnerable to attacks from the prosecution that its conclusions about proffered brain scans are unsubstantiated by the defendant’s personal history.  Such prosecutorial charges may bring

\[\text{167} \quad \text{Lockett v. Ohio, 438 U.S. 536, 631 (1978) (Rehnquist, J., concurring in part, dissenting in part).} \]

\[\text{168} \quad \text{See, e.g., United States v. Fields, 483 F.3d 313 (5th Cir. 2007).} \]  In considering the admissibility of expert psychiatric testimony on future dangerousness, the court observed that “[n]o Circuit that [it is] aware of has applied \textit{Daubert} to sentencing.”  \textit{Id.} at 342.  Rather, the barriers to the admission of evidence at capital sentencing hearings are “very low,” with the “sole statutory restriction” that “evidence may be excluded if it is more prejudicial than probative.”  \textit{Id.} at 343.

\[\text{169} \quad \text{Barefoot v. Estelle, 436 U.S. 880, 899 (1983).} \]
defense counsel into the disfavor of the jurors, who likely would feel that the defense team was intentionally trying to mislead them.

**CONCLUSION**

This article has focused predominately on the use of neuroimaging by criminal defendants to support their claims of mental illness. Part of the justification for permitting such evidence into the record during any stage of the trial is that the adversarial process allows the prosecution to rebut such testimony with its own experts’ interpretations of the data and perhaps even their own additional tests. As a result, this article has maintained that a defense attorney’s decision to introduce scans of the defendant’s brain and to explain the diagnosis derived therefrom will necessarily be a strategic one; the jury may credit the opposing experts’ conclusion instead, believing that the defense is trying to distract them from the real issues with flashy images and complicated neuroscientific claims. Moreover, rather than evoking their sympathy, members of the jury could contemplate what has been described to them as the damaged structure or function of a criminal’s brain and, fearing that the impairment is irreparable and that the defendant will pose a continuing threat to others, decide to remove the risk to society by imprisoning him.

This last countervailing consideration has broader implications for the criminal justice system. Fairness seems to dictate that once the defense introduces neuroimaging evidence, the prosecution should be able to use it to argue its case as well (within the bounds of sound scientific reasoning). As a matter of policy, however, should the prosecution be constrained to simply rebutting the defense’s claims about the significance of neuroimaging results? Or, rather, should the prosecution be allowed to use this data to make an affirmative case about what the defendant’s culpability is and what his punishment ought to be? This question is particularly poignant following *Kansas v. Hendricks*, in which the Supreme Court affirmed the constitutionality of the involuntary civil commitment of individuals who are likely to “engage in predatory acts of sexual violence” due to a “mental abnormality.” The Court rejected the defendant’s substantive due process and double jeopardy challenges, deferring to the Kansas legislature’s stated intent that the commitment proceedings were civil rather than criminal, and finding that the statutory requirements “limit[ed] involuntary civil confinement to those who suffer from a volitional impairment rendering them dangerous beyond their control.”

Noting precedent that “upheld civil commitment statutes that aim both to incapacitate and to treat,” the *Hendricks* majority opinion reasoned that nothing in the Constitution prevents a state “from civilly detaining those for whom no treatment is available, but who nevertheless pose a danger to others.” If this principle were expanded to violent crimes as well as sex crimes, then an individual who displayed purportedly irremediable anatomical abnormalities in regions of the brain associated with impulsive violence could, at least in theory, be confined indefinitely. Moreover, such civil confinement can “follow the expiration of a prison term without offending

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170 *Kansas v. Hendricks*, 521 U.S. 346, 350 (1997). As the Court explained it, the statute requires “proof of more than a mere predisposition to violence; rather, it requires evidence of past sexually violent behavior and a present mental condition that creates a likelihood of such conduct in the future if the person is not incapacitated.” *Id.* at 358.
171 *Id.* at 361.
172 *Id.* at 358.
173 *Id.* at 366.
double jeopardy principles.” If a criminal defendant introduced neuroimaging evidence during trial—whether in support of an NGRI defense or following a conviction as a mitigating factor during sentencing—but was found guilty and sentenced to a term of imprisonment, could that same neuroimaging evidence be resurrected before the defendant’s release to argue that his “mental abnormality” renders him a “continuing danger to society” necessitating civil commitment?

If so, it would appear that this article’s policy position, generally favoring the responsible use of neuroimaging throughout criminal trials, could have significant but hidden deleterious effects. In jurisdictions with statutes similar to the one at issue in *Hendricks*, defense counsel would be forced to choose between offering less than the complete and best evidence of defendant’s insanity or mental defect available, and risking that the same evidence would later be used by the state to institutionalize the defendant in civil proceedings—regardless of whether the NGRI plea succeeded or failed. As both the clinical use of neuroimaging and the enactment of civil commitment statutes become more prevalent, federal and state legislatures and the judiciary will need to clarify the procedural rules governing the extent to which neuroimaging is an appropriate basis upon which to civilly detain a potentially dangerous individual, particularly when the neuroimaging was performed and the results have been included in the subject’s medical record for nontherapeutic purposes.

As the field of neuroscience continues to evolve and neuroimaging technology continues to improve, there may come a point at which a defendant can claim an absolute right to show a jury how the structure and function of his brain rendered him insane, presently or at the time of the crime, or to show how his loss of self-control was not fully attributable to a conscious or manageable choice on his part. At such a point, one can also imagine a defendant raising Fifth Amendment objections to prosecutorial use of such images, under the theory that the data “confesses” his violent tendencies and incriminates him against his will. This hypothetical ability to chart the brain and reveal the workings of the mind with specificity, however, is nothing but a thought experiment now and likely will be for the foreseeable future.

Thus, the best policy for courts and legislatures to adopt with respect to neuroimaging is one that emphasizes flexibility and judicial discretion. As this article has shown, the rules of evidence provide trial judges with an array of tools for managing when and for what purposes either party may present neuroimaging data to the jury. Rather than a particular jurisdiction universally excluding or allowing such evidence in all criminal trials, each judge ought to examine the particular facts of the case before her, consider the purposes for which the neuroimaging evidence is proffered, assess the reliability of the experts’ methodology and the validity of the underlying science, and ensure ample opportunity for cross-examination of testifying expert witnesses. In other words, neuroimaging should be treated the same as any

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174 *Id.* at 369 (citing Baxstrom v. Herold, 383 U.S. 107 (1966)).

175 In his concurring opinion in *Hendricks*, Justice Kennedy notes that if “civil confinement were to become a mechanism for retribution or general deterrence, or if it were shown that mental abnormality is too imprecise a category to offer a solid basis for concluding that civil detention is justified, our precedents would not suffice to validate it.” 521 U.S. at 373 (Kennedy, J., concurring). This suggests that the Court is aware of the constitutional and scientific concerns if the holding of *Hendricks* is expanded farther beyond the particular facts of the case. When the Court reexamined the application of the statute nearly a decade later, it further clarified the potentially broad constitutionally permissible scope of civil commitment laws: the states “retain considerable leeway in defining the mental abnormalities and personality disorders that make an individual eligible for commitment,” Kansas v. Crane, 534 U.S. 407, 413 (2002), and only a “serious difficulty” rather than an complete inability to control behavior is necessary “when viewed in light of… the severity of the mental abnormality itself.” *Id.*
other type of scientific evidence, perhaps with an extra dose of caution because the functioning of the brain is so intimately connected to society’s conception of a guilty mind.

Moreover, as this article has demonstrated, the presumption in favor of admitting such evidence will vary throughout the different stages of criminal proceedings. Competency determinations, for instance, are concerned with the defendant’s current cognitive state, and neuroimaging can offer an immediate glimpse into the brain’s present condition. Indeed, as the technology becomes more widespread and neuroscience research more advanced, neuroimaging may become a regular part of some diagnostic procedures. In such circumstances, introducing and explaining the results would help the jury understand why the testifying experts came to their respective conclusions about the defendant’s competency.

During the case-in-chief, in contrast, the law is concerned with the defendant’s mental state at the time of the crime, and brain scans performed near the trial date may not accurately reflect any changes that have taken place in the interim. While this time lag is a shortcoming of any psychiatric testimony and while cross-examination can alert the factfinder to its potentially misleading nature, a prudent judge may decide in some situations that neuroimaging is best left out of the courtroom completely. Such a stance would be further justified by the lack of a constitutional mandate to allow NGRI defenses; the defendant’s due process rights are not violated by a state’s categorical refusal to permit presentation of evidence of insanity in any form as it may pertain to the question of guilt or innocence.

The presumption in favor of allowing the jury to see and weigh neuroimaging evidence returns with full force during the sentencing proceedings, accompanied by a constitutional imperative in capital cases that all relevant mitigating evidence be presented to the trier of fact. Of course, notwithstanding the judicial maxim that “death is different,” pseudoscience and baseless conjecture have no place in the courtroom. The rationale behind this exclusion is as much that it wastes the court’s time as it is that it might confuse the jury. As a general rule, defense experts who use neuroimaging to make a good faith claim about the defendant’s cognitive condition should be allowed before the sentencer, even if the connections or relationships to which they testify have not yet been established with absolute medical or scientific certainty.

In contrast, prosecution witnesses who wish to go beyond rebutting the defense’s claims and to use neuroimaging to establish the aggravating factor of future dangerousness should be forced to comply with the stricter Daubert or Frye standards before such testimony or evidence is admissible. Supreme Court jurisprudence requires that aggravating factors be proved beyond a reasonable doubt before the jury can take them into account in their sentencing decision, while consideration of mitigating circumstances carries no such burden; this reflects the broader judicial policy of allowing juries to show mercy for any reason, but strictly limiting capital punishment to the very worst offenders. While the prosecution can respond to any scientifically debatable claims by defense experts about the results of a brain scan by explaining any shortcomings in the examiner’s methodology, by introducing contradictory published research, or by highlighting other flaws, cross-examination may not be sufficient when jury confusion over or misinterpretation of prosecutorial expert testimony risks an unwarranted death sentence. As this article has consistently maintained, the best policy in sentencing as elsewhere will be to provide trial court judges wide latitude to assess the impact that controversial neuroimaging evidence is likely to have on the jury—giving due respect to jurors’ abilities to discriminate

176 Ring v. Arizona, 536 U.S. 584 (2002) (holding that in capital sentencing proceedings, a jury must find the existence of any statutory aggravating factors beyond a reasonable doubt).
between good and bad science and to account for an expert’s credibility in their ultimate determination—and to exclude or allow the evidence accordingly.