Not Guilty by Reason of Neuroimaging: The Need for Cautionary Jury Instructions for Neuroscience Evidence in Criminal Trials

ABSTRACT

Neuroimaging technology gives researchers the ability to see structures and functions of the human brain. As the technology advances, it is beginning to change the way the legal field understands the brain and its impact on legal concepts of capacity, sanity, guilt, and innocence. However, the sophisticated technology poses risks that juries will misunderstand the limits of the science or misapply the technical findings to a particular case. To combat the risk of undue prejudice, this Note proposes a cautionary jury instruction designed to remind jurors of the technical and legal limits of bringing neuroimages into the courtroom.

TABLE OF CONTENTS

I. ADMISSIBILITY OF SCIENTIFIC EVIDENCE AND EXPERT TESTIMONY .............................................................. 337
   A. Current Standards for Admissibility .................................. 337
   B. Fortifying the Gate.......................................................... 338
II. UNIQUE ADVANTAGES OF NEUROSCIENCE EVIDENCE............ 339
   A. Neuroimaging Technology ............................................. 339
   B. Current and Potential Future Uses of Neuroscience in the Courtroom ................................................................. 341
      1. Mens Rea .................................................................. 342
      2. Not Guilty by Reason of Insanity ................................. 343
III. IDENTIFYING THE RISKS OF NEUROSCIENCE EVIDENCE USING CAUTIONARY JURY INSTRUCTIONS TO REDUCE THEM......... 343
   A. Risks of Presenting Neuroscience Evidence to the Jury . 344
1. Misunderstanding the Technical Limits of Neuroscience ........................................ 344
2. Captivation ............................................................................................................. 345
3. Interpretation ......................................................................................................... 346

B. The Use of Jury Instructions .................................................................................. 347
   1. Ineffectiveness of Current Pattern Jury Instructions ........................................... 347
   2. Dispelling Juror Captivation and Reminding Jurors of their Role as Interpreters ..... 348
   3. The “Expert Substitute” Instruction to Explain Technical Limitations and Potentially Unreliable Clinical Applications .......................................................... 350

IV. SAMPLE INSTRUCTION ....................................................................................... 352
V. CONCLUSION ......................................................................................................... 353

The field of neuroscience is a window to the human brain. Neuroimaging technology gives researchers the ability to see structures and functions of the human brain. As scientific understanding of the brain improves, neuroscience discovers new possibilities for ethical, social, and legal analyses of human behavior.\(^1\) Specifically, neuroscience researchers seek to understand how human behavior, emotions, and cognitive processes are influenced by the brain.\(^2\) If researchers can use neuroimages to show a direct relationship between the brain and mental and behavioral processes, neuroscience could impact the legal analysis of personal responsibility for past actions, assessment of a person’s existing state of mind, and prediction of future behavior.\(^3\) Although technology may never advance to such a point, the mere possibility of new discoveries in neuroscience has generated an enormous amount of interest in the relationship between the brain structure and human behavior.\(^4\)

The legal field has begun to explore how neuroscience could impact the creation, interpretation, and enforcement of the law.\(^5\) For example, during the confirmation hearing for the nomination of Chief

---

2. Id. at 1273.
5. Id. at 1268.
Justice John Roberts to the Supreme Court, Senator Joe Biden of Delaware asked Mr. Roberts whether he thought “brain scans [could] be used to determine whether a person is inclined toward criminality or violent behavior” and suggested that Judge Roberts would be asked to rule on such a question during his tenure on the Supreme Court.\(^6\)

Neuroimaging has already begun to impact the types of evidence available in court. For example, in civil cases, neuroscience evidence can be used to prove actual harm in tort or to show that a party lacked sufficient cognitive capacity to form a valid contract.\(^7\) In the criminal context, defendants have used neuroscience evidence to show diminished capacity or insanity during the guilt phase and as a form of mitigating evidence during sentencing.\(^8\) As brain imaging techniques continue to gain scientific validity and acceptance, neuroscience will have an increasing impact on many areas of the legal field.\(^9\) In fact, some scholars predict that advances in neuroscience will one day “dominate the entire legal system.”\(^10\)

While such advances may provide a new form of evidence for parties in the justice system, such novel and complex technology has great potential to be misused or misunderstood.\(^11\) Lawyers, judges, and jurors may not fully understand the limits of the technology and may believe that neuroscience evidence is infallible truth.\(^12\) For example, scholars suggest that jurors are likely to overestimate the significance of expert testimony, particularly where the expert’s conclusions are supported by sophisticated or “hard” science.\(^13\) Furthermore, depending on how the witness presents the findings and

\(^6\) Id. at 1266.
\(^7\) Id. at 1291.
\(^8\) Id.
\(^10\) Snead, supra note 1, at 1268 (quoting Michael S. Gazzaniga, The Ethical Brain 88 (2005)).
the lawyers’ skills in direct and cross examination, the nature of the adversary process may distort the importance, relevance, and limits of complex scientific technology.\textsuperscript{14} Linking expert testimony about a party’s mental functioning with illustrations of that individual’s brain could have a profound impact on juror opinions and, consequentially, on the outcome of legal proceedings.\textsuperscript{15}

Currently, many neuroscientists and legal scholars encourage trial judges to avoid these risks by excluding most forms of neuroscience evidence from the guilt phase of criminal trials.\textsuperscript{16} Many trial courts have taken the advice and done just that.\textsuperscript{17} However, because trial judges have broad discretion in admitting and excluding evidence,\textsuperscript{18} there is no guarantee that only reliable evidence will be admitted or that shaky or potentially unreliable evidence will be excluded. Further, as neuroscience technology becomes more reliable, courts may begin to find that the probative value of such evidence outweighs the risk of confusing the jury.\textsuperscript{19} Therefore, the legal community should be aware of the full range of benefits and risks of using neuroscience evidence, and courts should be prepared to instruct jurors as to its precise risks and pitfalls.

This Note suggests a uniform cautionary jury instruction that can be used in any court to encourage the responsible use of neuroimaging evidence during criminal trials. Part I reviews the admissibility standards for scientific evidence and briefly examines some additional devices that courts may use to ensure that jurors receive only relevant and reliable evidence. Part II examines some current uses for neuroimaging in the courtroom, focusing on its use during the guilt phase of criminal trials. Part III identifies a variety of risks posed by neuroimaging evidence, including the risk that the jury will misunderstand the technical limits of neuroscience, will be overly-influenced by the evidence, or will misinterpret the significance of the evidence as it relates to a defendant’s behavior and mental

\textsuperscript{14} Id. at 167-68.


\textsuperscript{16} Khoshbin & Khoshbin, supra note 11, at 186 (arguing that neuroscience evidence should be admitted only to show structural abnormalities but not secondary evidence of brain activity).

\textsuperscript{17} United States v. Mezvinsky, 206 F. Supp. 2d 661, 666 (E.D. Pa. 2002) (excluding defendant’s proffered PET scan evidence because it could easily mislead the jury).


\textsuperscript{19} Kulynych, supra note 15, at 1251.
processes. Part IV suggests a jury instruction that includes warnings reflective of such risks.

I. ADMISSIBILITY OF SCIENTIFIC EVIDENCE AND EXPERT TESTIMONY

A. Current Standards for Admissibility

Trial courts have broad discretion in deciding whether to admit or exclude evidence, and within the evidentiary framework, one of the greatest challenges for courts is the task of determining the admissibility of novel scientific evidence introduced through expert testimony. Rule 702 of the Federal Rules of Evidence requires that “if any scientific, technical, or 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 . . . may testify thereto.” Rule 702 additionally requires that the underlying science be valid.

As recent Supreme Court decisions have articulated, judges serve as gatekeepers and therefore must determine the relevance and reliability of scientific evidence before it reaches a jury. Daubert v. Merrell Dow Pharmaceuticals and its progeny provide guidelines for determining the admissibility of expert testimony under Rule 702 and in doing so emphasize the function of judges to “protect juries from being bamboozled by technical evidence of dubious merit.” When evaluating the validity of proffered expert opinion, federal courts are required to assess four factors: (1) falsifiability, (2) error rate, (3) peer review and publication, and (4) general acceptance within the relevant scientific community. Using these guidelines, each court may make its own determination regarding the admissibility of novel scientific evidence in the case at hand. Because of the rate at which it is advancing, it is conceivable that both structural and functional

20. Beggs, supra note 18, at 816, 818.
22. Id.
24. Id; SmithKline Beecham Corp. v. Apotex Corp., 247 F. Supp. 2d 1011, 1042 (N.D. Ill. 2003), aff’d, 403 F.3d 1331 (Fed. Cir. 2005).
25. Although states are not bound to follow the federal standard, over half have done so. DAVID L. FAIGMAN ET AL., 1 MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY § 1:7, at 19 n. 8 (Thomson West 2008).
27. Id. at 597.
neuroimaging could soon reach a sufficient level of reliability to pass the Daubert test on a consistent basis.\(^\text{28}\)

However, reliability and relevance are not the only filters for scientific evidence; Rule 403 requires judges to balance the probative value of the proffered evidence against that risk that the evidence may create unfair prejudice for the opposing party, confuse the issues, or mislead the jury.\(^\text{29}\) Many courts that have found neuroscience evidence to be relevant and reliable have still excluded it because of the risk that it will mislead the jury.\(^\text{30}\)

\textit{B. Fortifying the Gate}

Rather than excluding neuroscience evidence as potentially unreliable or confusing the jurors, this section identifies some precautionary steps that permit the admission of the evidence while recognizing and addressing its frailties.\(^\text{31}\)

One possible solution is the use of court-appointed experts to assist the judges, as authorized by Rule 706 of the Federal Rules of Evidence.\(^\text{32}\) Concurring in \textit{General Elec. Co. v. Joiner}, Justice Breyer emphasized that, with the cooperation of the scientific community, the Daubert gatekeeping task “would not prove inordinately difficult to implement.”\(^\text{33}\) However, judges are reluctant to appoint experts because they believe that (a) the measure is only to be used in extraordinary circumstances and (b) the use of such experts will take away from the adversarial system of justice because such experts cannot be cross-examined.\(^\text{34}\) Furthermore, frequent use of independent experts could prove costly to courts.\(^\text{35}\)

\begin{footnotesize}
\begin{enumerate}
\item[29.] \textsc{Fed. R. Evid.} 403.
\item[30.] \textit{E.g.}, United States v. Pohlot, 827 F.2d 889, 890 (3d Cir. 1987) (“Presenting defense theories or psychiatric testimony . . . that do not truly negate mens rea may cause confusion about what the law requires.”); United States v. Mezvinsky, 206 F. Supp. 2d 661, 666 (E.D. Pa. 2002).
\item[31.] \textit{See, e.g.,} Snead, \textit{supra} note 1, at 1291-93.
\item[32.] \textsc{Fed. R. Evid.} 706; \textit{Daubert}, 509 U.S. at 595.
\item[33.] 522 U.S. 136, 150 (1997).
\item[34.] Ass’n of Mexican-Am. Educators v. California, 231 F.3d 572 (9th Cir. 2000); Joe S. Cecil & Thomas E. Willging, \textit{Accepting Daubert’s Invitation: Defining a Role for Court-Appointed Experts in Assessing Scientific Validity}, 43 EMORY L.J. 995, 1018-19 (1994) (noting that attorneys are unable to cross-examine the expert and that any determinations made are not a source of evidence).
\item[35.] Beggs, \textit{supra} note 18, at 840.
\end{enumerate}
\end{footnotesize}
**JURY INSTRUCTIONS AND NEUROSCIENCE**

*Daubert* also suggests that “[v]igorous cross-examination [and] presentation of contrary evidence” are the “traditional and appropriate means of attacking shaky but admissible evidence.” 36 But in criminal trials, the quality of cross-examinations and effective presentation of contrary evidence is reliant on the skill and dedication of each trial attorney. 37 Despite protections available through the Rules of Evidence and the adversarial system, instructions to the jury often serve as the last defense against questionable or potentially misleading evidence.

II. **UNIQUE ADVANTAGES OF NEUROSCIENCE EVIDENCE**

Advances in scientific technology are expanding the universe of potential evidence and forcing courts to make difficult decisions regarding the admissibility, reliability, and probative value of such evidence. Neuroscience offers tempting possibilities that science may be able to reveal the inner workings of a person’s mind. 38 However, the brain is a complex system, and science has only begun to probe the relationship between the structure and functioning of the brain and the resulting effect on human mental and behavioral processes. 39

A. **Neuroimaging Technology**

Before discussing the use of neuroimaging in the courtroom, it is important to distinguish between brain structure and brain functioning. The term “neuroimage” refers to computer-generated representations of the brain and can be used to describe both structural and functional images. 40 To observe the brain’s structure, experts typically use computed tomography (CT) scanning and magnetic resonance imaging (MRI). 41 For example, these imaging techniques can reveal a lesion or other physical abnormality caused by a trauma, brain disease, or other reasons. 42 Some scholars argue that courts should allow only this most basic form of brain imaging as

---

36. 509 U.S. at 596.
39. *Id.* at 1258.
40. *Id.* at 1255.
41. Snead, *supra* note 1, at 1281.
evidence in court because it depicts the physical, observable structures of the brain.\textsuperscript{43}

The newer forms of neuroimaging technology, most notably the functional MRI (fMRI), record the functioning of the brain by locating active brain areas by measuring blood flow to particular region of the brain.\textsuperscript{44} While CT and MRI scans basically show a black and white picture of the brain structure, the fMRI scans show localized changes in blood flow, referred to as “hot spots.” A researcher then superimposes these hot spots over a realistic three-dimensional computer image of the brain to create a comprehensive picture of the brain’s structure and function.\textsuperscript{45} This new technology has garnered significant academic and public excitement because it creates the possibility for scientists to discern a causal relationship between brain function and corresponding cognitive processes such as thinking, feeling, or believing.\textsuperscript{46} Studies also indicate that fMRI technology may also be able to identify the neural correlates of behaviors and conditions such as deception, depression, addiction, racial perception, and sexual preferences.\textsuperscript{47} However, this technology cannot yet reliably identify or predict the relationship between the human brain and human behavior. Thus, the legal community should be cautious about its use in court.\textsuperscript{48}

Figure 1: Comparison of MRI and fMRI Neuroimages

\begin{itemize}
\item[43.] Id.
\item[44.] Snead, supra note 1, at 1282-84.
\item[45.] Id.
\item[46.] See id. at 1285.
\item[48.] Kulynych, supra note 15, at 1266.
\end{itemize}
The MRI scan, typically in black and white, depicts the brain's structure. The fMRI scan, typically in color, identifies the level of blood flow to particular brain regions, indicating both structure and function.

**B. Current and Potential Future Uses of Neuroscience in the Courtroom**

Despite the limits to the technology, neuroscience has the potential to enormously benefit the legal field and neuroscience evidence has already begun making its way into the courtroom.\textsuperscript{49} However, due to the immaturity of fMRI technology, parties currently use primarily CT and MRI images to show structural abnormalities in the brain itself.\textsuperscript{50} In civil cases, structural neuroimaging evidence has been proffered to prove actual harm to the brain in personal injury, medical malpractice, and toxic exposure cases; additionally, structural neuroimaging has been introduced in contract disputes to show that one of the parties lacked sufficient cognitive capacity to form a valid contract.\textsuperscript{51} In the criminal context, defendants have attempted to introduce neuroscience evidence at a number of points throughout the process, including the preliminary determination of competency to stand trial, the guilt phase, and the sentencing phase.\textsuperscript{52} For example, neuroscience evidence has been used as mitigating evidence during the sentencing phase of capital trials to persuade the jury that a particular defendant, due to abnormalities of the brain, has less...

\textsuperscript{49} See discussion supra Part I.A.2.
\textsuperscript{50} Khoshbin & Khoshbin, supra note 11, at 186.
\textsuperscript{51} Snead, supra note 1, at 1291-92.
\textsuperscript{52} Id. at 1292.
criminal culpability and should not be sentenced to death.\footnote{Id. at 1293.} This sort of use is simpler: evidence admitted for the purpose of mitigation in sentencing need not conform to the Rules of Evidence, and therefore courts have had wider latitude in allowing defendants to introduce neuroimaging evidence.\footnote{Erica Beecher-Monas \& Edgar Garcia-Rill, Danger at the Edge of Chaos: Predicting Violent Behavior in a Post-Daubert World, 24 CARDOZO L. REV. 1845, 1846 (2003).}

Although the majority of neuroscience evidence is admitted during the sentencing phase,\footnote{See id.; Snead, supra note 1.} neuroimaging has been allowed during the guilt phase, particularly to argue the defendant’s inability to form the requisite mens rea or to raise an insanity defense.\footnote{President’s Council Overview, supra note 9, at pt. II.A.1.} Still, using scientific evidence to make a determination of a defendant’s guilt or innocence raises critical questions as to its reliability.\footnote{Underwood, supra note 13, at 151.}

1. Mens Rea

In order to prove a defendant’s guilt, the prosecution must prove not only that the defendant committed each physical element of the crime, but also that the defendant possessed the requisite level of mental culpability (mens rea) at the time of the crime.\footnote{The Model Penal Code identifies four levels of mental culpability: purpose, knowledge, recklessness, and negligence. § 2.02(2) (1981).} In \textit{State v. Anderson}, defense counsel introduced expert testimony supported by neuroscience evidence to show that the defendant’s brain-damage-induced depression and paranoia negated his ability to premeditate and deliberate in a manner sufficient to justify the charge of first-degree murder.\footnote{79 S.W.3d 420, 433 (Mo. 2002). Despite the successful introduction of neuroscience evidence, the jury found Anderson guilty of two counts of first-degree murder and sentenced him to the death penalty. \textit{Id.} at 429.}

If science develops sufficiently to accurately show an individual’s brain functioning, neuroimaging evidence of a defendant’s state of mind may be admissible for future trials. Using functional neuroimaging, it may be possible to determine whether a defendant is being truthful in describing current or past perceptions.\footnote{Erin Ann O’Hara, \textit{How Neuroscience Might Advance the Law}, in \textit{Law and the Brain} 21, 29 (Semir Zeki \& Oliver Goodenough eds., 2006).} Additionally, a charge of murder could be reduced to manslaughter if a defendant could show that, at the time of the killing, the defendant
was provoked to a level that would cause the average person to lose control. For example, many legal and psychological theorists argue that women who have been victims of domestic violence may “snap” and kill their spouses even if there was no temporal provocation; neuroimaging studies may help to prove the existence of a Battered Women’s Syndrome and show that “reasonable provocation” need not be temporal in these circumstances.

2. Not Guilty by Reason of Insanity

Neuroimaging could also help courts make more accurate assessments of defendants’ sanity. The Supreme Court has ruled that the Constitution requires that a state provide access to a psychiatrist’s evaluation when the defendant’s sanity is disputed. This holding suggests willingness for federal trial courts to broadly admit psychological evidence as part of an insanity defense. The same is also true for some state courts. In 1994, a New York state appellate court found that the trial court’s failure to admit neuroimaging tests as part of an insanity defense constituted reversible error.

Relying on the right to present psychiatric evidence, many defendants have offered neuroscience evidence of brain deficiencies as part of an insanity defense. One famous example of using brain imaging as part of such a defense is United States v. Hinckley. In that case, the defendant attempted to assassinate President Reagan. At trial, the defense presented neuroscience evidence in the form of a CAT scan indicating that the defendant may have been suffering from an organic brain disease. Although it isn’t clear exactly what impact the neuroscience evidence had, Hinckley was ultimately found not guilty by reason of insanity. In future cases, as the technology of functional neuroimaging improves, experts may be able to testify to specific cognitive defects that tend to show a defendant’s insanity.

III. IDENTIFYING THE RISKS OF NEUROSCIENCE EVIDENCE USING

61. President’s Council Overview, supra note 9, at pt. I.A.1.
62. Id.
66. Id.
67. Id.
69. President’s Council Overview, supra note 9, at pt. II.A.2.
CAUTIONARY JURY INSTRUCTIONS TO REDUCE THEM

A. Risks of Presenting Neuroscience Evidence to the Jury

Assuming a defendant has access to psychological testing that includes neuroimaging, the defense must first convince the trial judge to admit an expert witness qualified to testify about the defendant’s neurological testing.\(^70\) If the evidence is admitted, there are several potential risks posed by presenting it the jury, namely misunderstanding, captivation, and interpretation.

1. Misunderstanding the Technical Limits of Neuroscience

Functional neuroimaging provides information about brain functioning in general, but it cannot fully explain brain functioning on an individual basis.\(^71\) An individual’s brain could be affected by any number of external factors or circumstances that may cause one person to perform mental or behavioral tasks differently than another person, only some of which are relevant to the justice system.\(^72\) Thus, there is no reliable baseline for determining whether one individual’s brain functioning qualifies as “normal.”\(^73\)

Furthermore, the brain is incredibly complex—there is not one single area that controls a person’s thoughts or actions;\(^74\) rather, there is an interconnectedness between different parts of the brain that cannot always be captured by scans or images.\(^75\) Because fMRI experiments measure brain activity while the subject performs one simple and specific experimental task, it is difficult to extrapolate results from the controlled experimental setting to everyday life, where a person may be performing several tasks simultaneously.\(^76\)

Similarly, any given area of the brain could be responsible for multiple cognitive functions and, therefore, imaging cannot

\(^{70}\) See discussion supra Part II.A.

\(^{71}\) Richard Robinson, fMRI Beyond the Clinic: Will It Ever Be Ready for Prime Time?, 2 PLOS BIOLOGY 715, 716 (2004).

\(^{72}\) Greely & Illes, supra note 11, at 382.

\(^{73}\) See Snead, supra note 1, at 1289-90.

\(^{74}\) Khoshbin & Khoshbin, supra note 11, at 186-87.


\(^{76}\) Greely & Illes, supra note 11, at 383. For example, one study asked participants to memorize a long string of numbers while measuring blood flow to active brain regions during the task. Bloom, supra note 12.
conclusively demonstrate which function corresponds to an active brain area. Once a relationship is established between a brain area and neural functioning, there is a deductive gap between the hard science of the imaging studies and the subjective clinical interpretations admissible as evidence in court. Additionally, research has not produced reliable diagnostic imaging tests to identify psychological and mental impairment. Although the technology is rapidly evolving and it may quickly reach the point where certain cognitive processes could be reliably identified using neuroimaging, it is imperative that judges, lawyers, and jurors understand the current limitations.

2. Captivation

Because brain images are “profoundly fascinating to view, neuroimaging scans have the ability to unduly influence and captivate the jury.” Visual aids—including photographs, diagrams, and charts—are often used in court, but images of the brain are especially fascinating because a testifying expert endorses them as scientific data. Images from fMRI scans are particularly problematic in the courtroom because the visual impact is impressive compared to scans produced by other imaging technology. The fMRI scans produce a realistic, three-dimensional image of the brain with color mapping of blood flow, and their level of sophistication is not equaled by the black-and-white two-dimensional MRI images.

In addition to the captivating visual, the science of studying the brain has a certain allure to laypersons. If society perceives the brain to be powerfully determinative of who a person is, jurors, as well as the lay public in general, may be willing to accept neuroscientific explanations of behavior. Dr. Paul Bloom, a cognitive psychologist at

77. Snead, supra note 1, at 1288.
81. Khoshbin & Khoshbin, supra note 11, at 182.
82. Id.
83. Kulynych, supra note 15, at 1257.
84. Garland & Frankel, supra note 80, at 107-08.
Yale, believes that brain imaging has a seductive appeal that exceeds its actual power to explain mental and emotional states. He writes:

Psychologists can be heard grumbling that the only way to publish in *Science* or *Nature* is with pretty color pictures of the brain. The media, critical funding decisions, precious column inches, tenure posts, science credibility and the popular imagination have all been influenced by fMRI’s seductive but deceptive grasp on our attentions. It’s a pervasive influence, and it’s not because the science is better.

Since neuroscience mimics hard science more than other forms of psychological testing, Dr. Bloom believes that fMRI imagery has attained undue influence.

Professor Richard Underwood, a Professor of Law at University of Kentucky College of Law, describes this phenomenon as the “gee whiz factor.” Even if the expert witness is completely straightforward about the significance of the results (whereas some witnesses could attempt to overstate the significance of the results), a juror may overestimate their importance because they are impressed by the sophistication. Deena Skolnick, a former graduate student at Yale, captured this phenomenon in an experiment she performed while in graduate school in which she asked her subjects to judge different explanations of psychological occurrences. She found that people were generally able to identify incorrect explanations; however, when researchers supplemented the incorrect explanations with a few sentences of neuroscience reasoning—even though the neuroscience explanations were inaccurate and unrelated—people tended to perceive these explanations as more credible than those without the neuroscience support. Thus, the presence of a bit of apparently hard science turned bad explanations into satisfactory ones.

3. Interpretation

When testifying as to the results of neuroimaging tests, a qualified neuroscientist would “readily acknowledge the limited evidentiary purposes for which neuroimaging is currently appropriate.” However, neuroimaging is often introduced for the

86. *Id.*
87. *Id.*
89. *Id.*
91. *Id.*
92. *Id.*
purpose of making a psychiatric diagnosis, and the testifying psychiatrist (who may be an expert in mental illness rather than neuroscience technology) may not have a thorough understanding of the technical limits and problems of clinical application; accordingly, she may be unable to adequately convey these issues to the jury. Additionally, a skillful attorney could mislead even a qualified neuroscientist during direct or cross examination, thus causing the neuroscientist to overemphasize the diagnostic value of brain scans. When this sort of misinterpretation occurs, the jury has no way of understanding the technical limits of neuroscience unless the opposing party calls a refuting expert witness or the court gives a cautionary instruction.

B. The Use of Jury Instructions

Due to the high probative value of neuroscience evidence, courts should not completely exclude neuroscience evidence on the basis of the dangers noted above. Instead, they should craft cautionary jury instructions to lower the risk of prejudice. As part of the final instructions to the jurors prior to their deliberation, the judge instructs the jury regarding the weight or reliability of expert facts and opinion testimony. Factors to be considered by the jury in determining the relative weight and sufficiency of expert testimony include: (1) ability and character of the witness, (2) witness’s actions on the witness stand, (3) weight and process of reasoning by which the expert has supported her opinions, (4) possible bias in favor of side for whom witness is testifying, (5) whether the witness is being paid, (6) relative opportunities for study or observation of the subject at issue, and (7) any other matters that serve to illuminate the witness’s statements. This final factor leaves open the possibility for courts to give further instructions as needed for particularly troublesome evidence.

1. Ineffectiveness of Current Pattern Jury Instructions

Jurors are generally instructed that they must make their own determination as to the weight and credibility of the expert witness’s

97. 31A AM. JUR. 2d Expert and Opinion Evidence § 109 (Westlaw 2009).
testimony in connection with the other evidence and that it is permissible to reject the testimony entirely. The sample general instructions for consideration of expert witness in federal criminal cases state:

You should consider each expert opinion received in evidence in this case and give it such weight, if any, as you may think it deserves. You should consider the testimony of expert witnesses just as you consider other evidence in this case. If you should decide that the opinion of an expert witness is not based upon sufficient education or experience, or if you should conclude that the reasons given in support of the opinion are not sound, or if you should conclude that the reasons given in support of the opinion are not sound, or if you should conclude that the opinion is outweighed by other evidence (including that of other "expert witnesses"), you may disregard the opinion in part or in its entirety. As I have told you several times, you – the jury – are the sole judges of the facts of this case.

This pattern instruction does not indicate to the jury that there may be problems of reliability inherent in the science or that scientific images may exert undue influence; neuroscience evidence requires more specific instructions to warn jurors of its potential risks. Further, it may create an aura of infallibility by referring to the witness as an "expert."

2. Dispelling Juror Captivation and Reminding Jurors of their Role as Interpreters

Since the conveyance of scientific testimony aided by captivating visual images suggests that the testimony is highly persuasive, many courts fear that jurors will give undue weight to information conveyed by experts. In addition, as discussed above the reliability of neuroscience evidence is still a topic of debate in both the scientific and legal communities. Common sense suggests that jurors will have some tendency to defer to a scientific expert rather than trust their own knowledge and judgment, causing courts fear that expert testimony could cause the jurors to forget their roles as the ultimate deciders of fact.

98. Marvel, supra note 96, § 3.
100. See Kulynych, supra note 15 and accompanying text.
102. See discussion supra Part II.A.
103. Doyle, supra note 101, at 637.
104. Id. at 640.
However, through jury instructions, judges have some ability to control the aura of expertise and remind jurors of their responsibilities.\textsuperscript{105} Although it would be "naïve to think that a cautionary instruction is always a 'talisman for the solution of any possible prejudice problem,'" there are reasons to think that cautionary instructions have some influence over jurors.\textsuperscript{106} For example, jurors are predisposed to trust their own judgment, and an instruction that encourages them to do so should be well received.\textsuperscript{107} In \textit{Daubert}, Justice Blackmun suggested that careful instruction on the burden of proof should be a means of attacking "shaky but admissible" evidence.\textsuperscript{108} Although the Court specifically referred to instructions on the burden of proof, this comment generated interest in the use of other types of jury instructions, including scientific evidence.\textsuperscript{109}

Shortly after \textit{Daubert}, Judge McKenna in the Southern District of New York drafted a new cautionary instruction relating to forensic expert testimony in \textit{United States v. Starzecpyzel}.\textsuperscript{110} The ruling came on a motion by the defendant to exclude expert testimony on forensic document examination (handwriting analysis or "FDE").\textsuperscript{111} The court expressed concern that jurors could view FDE as a science instead of a technical experience acquired by through "training, apprenticeships, and long years of practice" and thereby defer to such testimony as an infallible scientific finding.\textsuperscript{112} Rather than excluding the evidence because of its potential to improperly influence juries, the court ruled that the prejudice problem does not require the exclusion of the proffered testimony.\textsuperscript{113} "While [forensic] evidence presents special challenges, '[t]he jury is intelligent enough . . . to ignore what is unhelpful in its deliberations.'"\textsuperscript{114}

As part of the protections required by such evidence, the court suggested a cautionary jury instruction focused on the practical, probative value of the evidence:

\begin{itemize}
\item \textsuperscript{105} Id.
\item \textsuperscript{106} Edward J. Imwinkelried, \textit{Impoverishing the Trier of Fact: Excluding the Proponent's Expert Testimony Due to the Opponent's Inability to Afford Rebuttal Evidence}, 40 CONN. L. REV. 317, 350 (2007)(quoting United States v. Schiff, 612 F.2d 7, 82(2d Cir. 1979)).
\item \textsuperscript{107} Doyle, \textit{supra} note 101, at 639.
\item \textsuperscript{108} Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 596 (1993).
\item \textsuperscript{109} Imwinkelried, \textit{supra} note 106, at 350.
\item \textsuperscript{110} 880 F. Supp. 1027, 1049 (1995).
\item \textsuperscript{111} \textit{Id.} at 1028.
\item \textsuperscript{112} \textit{Id.} at 1029.
\item \textsuperscript{113} \textit{Id.} at 1049.
\item \textsuperscript{114} \textit{Id.} (quoting United States v. Jakobetz, 955 F.2d 786, 797 (2d Cir. 1992)).
\end{itemize}
Witnesses are usually permitted to testify only as to matters within their direct experience, such as what they saw or what they did on a particular occasion. Witnesses are not generally allowed to express their opinions. However, some individuals are permitted to offer their opinions because they have acquired a skill, through their training, education or experience, that few members of the general public possess. Such witnesses are frequently referred to as “experts” or “expert witnesses.” You may accept a forensic document examiner’s testimony in whole, or you may reject it in whole. If you find that the field of forensic document examination is not sufficiently reliable, or that the particular document examiner is not sufficiently reliable, you are free to reject the testimony in whole. You may also accept the testimony in part, finding, as one possible example, that while the forensic document examiner has found significant similarities and differences between various handwriting samples, his or her conclusion as to the genuineness of a particular writing is in error, or is inconclusive. In any event, you should not substitute the forensic document examiner’s opinion for your own reason, judgment, or common sense. I am not in any way suggesting what you should do. The determination of the facts in this case rests solely with you. Such an instruction eliminates the assumption that an expert’s testimony is foolproof and suggests forensic scientists are not scientists in the same way that physicists and chemists are, instead comparing them to craftsmen. This allows the jury to weigh the evidence in its proper context. The instruction also indicates the jurors need not accept the field of forensic document examination as a reliable science, but can use their own judgment and common sense to determine whether to credit the testimony. However, the instruction stops short of explaining precise limits of the FDE method and therefore does not fully reduce the risks of jury captivation or misinterpretation.

3. The “Expert Substitute” Instruction to Explain Technical Limitations and Potentially Unreliable Clinical Applications

Some courts have responded to the problem of scientifically unreliable testimony by allowing opponents to introduce an expert witness solely for the purpose of refuting the science underlying the earlier opinion. As a less costly alternative, courts have used cautionary “expert substitute” jury instructions to educate jurors about the risks and frailties of the earlier testimony. 

115. Starzecpyzel, 880 F. Supp at 1050.
117. Id.
118. See id.
States v. Burrous, expert substitute instructions were used to explain the dangers of misidentification inherent in eyewitness testimony.\textsuperscript{121} Rather than admitting expert testimony about the frailty of eyewitness and lineup identification, the court included the following language in its instructions to the jury:

I want to caution you, first, that the kind of identification testimony you heard in this case must be scrutinized carefully. Scientific studies have amply demonstrated the dangers of mistake in human perception and identification. . . . You may also consider that an identification made by picking the defendant out of a group of similar individuals, or a group of photographs of similar individuals, is generally more reliable than one which results from the presentation of the defendant alone to the witness or among a group of persons with significantly different appearances.\textsuperscript{122}

In Canadian courts, judges offer even more cautionary jury instruction on the frailties of eyewitness testimony including matters such as the weak relationship between eyewitness confidence and accuracy, the risk of mistakenly identifying as the perpetrator one whose face is familiar from another context, and the low value of in-court identifications.\textsuperscript{123} However, most courts in the United States refrain from offering such detailed instructions regarding witness testimony for fear that it would be construed on appeal as judicial comment on the evidence that threatens to invade the province of the jury.\textsuperscript{124} As a result, trial courts must walk a fine line between mitigating the risk that scientific expert testimony will overly influence the jury and the risk that cautionary instructions will do the same.

To alleviate this problem, reviewing courts should allow the trial judge greater latitude in crafting cautionary instructions regarding the jury’s assessment of expert testimony. Neuroimaging evidence has the potential to make significant contributions to the justice system but also carries a particular risk of captivating jurors and causing them to rely on immature science, and judges should have the freedom to caution jurors about those risks.

\textsuperscript{121} Burrous, 934 F. Supp. at 530. Although eyewitness testimony is not a form of expert evidence, the idea of explaining the risks inherent in a certain form of testimony is the same. Id.

\textsuperscript{122} Id. at 530-31.


IV. SAMPLE INSTRUCTION

This sample jury instruction incorporates concepts from several of the above instructions, including: (1) instructing the jury not to assume the testifying witness is a scientific expert, but rather a witness qualified as an expert for the purposes of trial, (2) describing some limitations of neuroscience (the expert substitute instruction), (3) instructing jurors that they may accept or reject neuroscience evidence on the whole, and (4) reminding jurors of their role as fact-finders.

1. Description of the Witness: Ordinarily, witnesses are permitted to testify only as to matters within their direct experience, such as what they saw or what they did on a particular occasion. Witnesses are not generally allowed to express their opinions. However, some individuals are permitted to offer their opinions because they have particular training, education or experience that few members of the general public possess. Such witnesses are frequently referred to as “experts” or “expert witnesses.” Today, you heard testimony from ____________, who has been trained in the field of neuroscience/psychiatry. [Witness name] was permitted to use visual aids to assist with his/her testimony.

2. Technical and Interpretive Risks: I want to caution you, first, that the kind of testimony you heard in this case must be scrutinized carefully. The field of neuroscience is not a precise science, like physics or chemistry, but a technique of viewing the human brain and interpreting the images. The conclusions from this interpretation are subjective, not objective scientific fact. Researchers cannot determine with complete certainty how a particular area of the brain or an abnormality in that area will affect a given individual. They also cannot determine with complete certainty the connection between a person’s brain and his or her thoughts, beliefs, or actions. The images used to assist during the testimony should not be mistaken for proof of any relevant facts in this case. All testimony is that witness's professional opinion, and you must determine whether to credit or reject the evidence.

[For fMRI imaging: Researchers cannot use neuroimaging to identify the specific cause of behavior, but instead can only see which areas of the brain are active when a person is performing a particular task. For example, if the frontal region is active while a person is recalling a past event, the researcher would be able to detect this. However, the information does not necessarily indicate that a person exclusively uses his frontal region for recollection—a person can use multiple areas of the brain for a given activity, and similarly each area of the brain could control multiple functions.]

3. Juror’s Responsibility: You may accept the testimony in whole, or you may reject it in whole. If you find that the field of neuroscience is not sufficiently reliable, or that the particular witness is not sufficiently reliable, you are free to reject the testimony in whole. You may also accept the testimony in part, finding, as one possible example, that while the witness has found significant similarities and differences between various patterns of brain function, his or her conclusion as to the genuineness of a particular

126. See discussion supra Part II.A.1.
128. Id.
diagnosis is in error, or is inconclusive. In any event, you should not substitute the witness’s opinion for your own reason, judgment, or common sense. I am not in any way suggesting what you should do. The determination of the facts in this case rests solely with you.

These instructions focus on the difference between an expert witness’s opinion and scientific fact and remind the jurors that they must determine the facts of the case. In an attempt to dispel the aura of infallibility, they also carefully refer to the “witness” rather than the “expert witness.” Like the jury instruction about Forensic Document Examination,129 it suggests that the field of neuroscience is not a hard science, but rather a matter of interpretation.130

Although the instruction does not give detailed information about the science, it conveys enough information to alert the jury about its possible shortcomings. In some jurisdictions, the judge may be able to give even more explicit instructions regarding the neuroscience as a definitive explanation for human behavior and the problem of image captivation. As discussed above, it would be ideal for reviewing courts to allow more latitude for trial courts in instructing jurors on neuroscience or other forms of complex scientific evidence.131 However, a reviewing court could determine that such an instruction constitutes impermissible comment on the evidence, and could overturn the trial court’s judgment. As neuroscience advances, neuroimaging evidence will become increasingly sophisticated, and courts must be able to keep up by using advanced jury instructions that reflect the risks of using and understanding the technology.

V. CONCLUSION

The increasing public, legal, and academic interest in the field of neuroscience indicates that neuroimaging evidence may assume a more prominent position in a variety of types of litigation. However, the technology is still relatively new, and many of the capabilities of neuroscience are not yet known. Courts should proceed with extreme caution when determining the evidentiary admissibility of neuroscience evidence. In cases where the evidence is admitted, the court must carefully instruct jurors so as to the limits and risks of the science. Although many legal theorists question the effectiveness of jury instructions, clear instructions that list specific risks may be well-received by jurors and will reduce the risks of admitting the

130. See supra notes 110-118 and accompanying text.
131. See discussion supra Part III.2.c.
The sample instruction offered in this note cover some of the major risks by identifying technical, professional, and scientific limitations of neuroscience evidence.

History shows that science has often been used inappropriately in the creation of law and public policy. In the late nineteenth century, the theory of anthropological criminality, proposed by Italian scientist Cesare Lombroso, advanced the notion that criminals were born with detectable physiological inferiorities that could be identified and categorized to predict a person’s predisposition toward criminality. In particular, Lombroso believed that Southern Italians were more prone to crime than Northern Italians, and Lombroso’s followers subscribed to the idea that certain races and ethnic groups were genetically more likely to commit crimes. Although this theory was eventually discredited, similar theories may still impact modern criminal profiling.

One of the most harrowing examples of legal misuse of science was the emergence of eugenic sterilization laws in the United States during the 1920s and 1930s. Like Lombroso’s theory, the idea was to identify and sterilize the “feeble-minded” and thereby eliminate inherited criminality. The Supreme Court upheld the constitutionality of such laws. The words of Justice Holmes should serve as a cautionary tale:

It is better for all the world, if instead of waiting to execute degenerate offspring for crime, or to let them starve for their imbecility, society can prevent those who are manifestly unfit from continuing their kind. The principle that sustains compulsory vaccination is broad enough to cover cutting the Fallopian tubes. Three generations of imbeciles are enough.

While scientific research and experimentation is primarily a continuing dialogue of hypotheses, replication, and reevaluation, the

---

132. See discussion supra Part III.2.b.
133. Garland & Frankel, supra note 80, at 109-10. Lombroso outlined fourteen characteristics that he believed indicated a predisposition towards criminal behavior: unusually short or tall height; small head, but large face; fleshy lips, but thin upper lip; protuberances (bumps) on head, in back of head and around ear; wrinkles on forehead and face; large sinus cavities or bumpy face; tattoos on body; receding hairline; bumps on head, particularly above left ear; large incisors; bushy eyebrows, tending to meet across nose; large eye sockets, but deep-set eyes; beaked or flat nose; strong jaw line; small and sloping forehead; small or weak chin; thin neck; sloping shoulders, but large chest; large, protruding ears; long arms; high cheek bones; pointy or snubbed fingers or toes. Wikipedia, Anthropological Criminology, http://en.wikipedia.org/wiki/Criminal_anthropology (last visited Nov. 2, 2009).
134. Id.
135. Garland & Frankel, supra note 80, at 110.
136. Id.
legal field operates on a more pressing time frame, using the available tools to solve an immediate conflict. These examples illuminate the risks of using brain imaging to solve immediate conflicts or predict future behavior, and judges and lawyers should proceed slowly and carefully when considering the use of neuroscience evidence, particularly when making decisions regarding a person’s guilt or innocence.

Courts must be aware that the connection between what scientists know about general brain physiology and functioning and what clinicians can determine by studying an individual brain is tenuous and unsupported by significant scientific data. However, the use of neuroimaging evidence in the courtroom is likely to increase and, as a result, courts must have a strategy for how to frame such evidence for the jury. Certainly, jury instructions should only be one piece of a court’s cautionary strategy, but they represent a significant step towards striking a balance between excluding the evidence and confusing the jurors.

_E. Spencer Compton*

139. See discussion _supra_ Part III.1.a.
140. _See_ Snead, _supra_ note 1 at 1267-69.

*J.D. Candidate, Vanderbilt University Law School, 2010; A.B., Religion, Princeton University, 2005. The author would like to thank Professor Owen Jones for guidance and the entire staff of the Vanderbilt Journal of Entertainment and Technology for their help with thinking, writing, and editing.