

Neuroimaging, Culture, and Forensic Psychiatry

Neil K. Aggarwal, MD, MBA, MA

The spread of neuroimaging technologies around the world has led to diverse practices of forensic psychiatry and the emergence of neuroethics and neurolaw. This article surveys the neuroethics and neurolegal literature on the use of forensic neuroimaging within the courtroom. Next, the related literature within medical anthropology and science and technology studies is reviewed to show how debates about forensic neuroimaging reflect cultural tensions about attitudes regarding the self, mental illness, and medical expertise. Finally, recommendations are offered on how forensic psychiatrists can add to this research, given their professional interface between law and medicine. At stake are the fundamental concerns that surround changing conceptions of the self, sickness, and expectations of medicine.

J Am Acad Psychiatry Law 37:239–44, 2009

The use of neuroimaging for forensic purposes has sparked increasing interest and scholarly attention around the world in recent years. For example, in 2002 and 2005, the Iowa Supreme Court and an Oklahoma appeals court, respectively, dismissed brain-fingerprinting electroencephalographic evidence for not meeting legal standards of reliability.^{1,2} In 2007, the British Home Secretary John Reid announced that convicted pedophiles must submit to magnetic resonance imaging (MRI) scanning to assess the risk of re-offense, leading to questions about whether medical technology could detect crimes and whether criminals could be convicted for acts hitherto uncommitted.³ In 2008, Indian courts convicted two suspected murderers largely on evidence from Brain Electrical Oscillations Signature (BEOS), a form of brain fingerprinting in which EEG electrodes are placed, short questions covering a range of neutral and incriminating topics are recorded, differences in brain signals upon answer playback are measured, and results as to whether the accused had experiential knowledge of the event are interpreted.⁴ Within three months, a committee of experts from the Indian National Institute of Mental Health and Neuro Sciences (NIMHANS) recommended discontinuing BEOS in investigative and

evidentiary procedures, since the studies had not accounted for constitutional variations such as body temperature, heart rate, sex, endurance, and age.⁵ American experts also expressed alarm that Indian BEOS experiments had not undergone peer review in academic journals or replication in other laboratories.⁶

To grapple with the growing interface between neuroscience and society, two related academic disciplines have emerged: neuroethics and neurolaw. Introduced as a term in the late 1980s, neuroethics evolved with a formal research agenda during a conference in 2002, at which neuroscientists, bioethicists, attorneys, and policy analysts convened to discuss the brain with relation to the self, social policy, ethics, and public discourse.⁷ Topics of interest included the existence of free will, mind-body reductionism, personal identity, informed consent, cognitive manipulation, and national security.⁸ Relevant to psychiatry are considerations of how medications and neuroimaging impact personality and mental illness.^{9,10} Although some dispute the degree to which neuroethics represents a new branch of bioethics, neuroethicists are determined to develop their own ideas and practices.^{11–13}

Similarly, neurolaw has been promoted by legal experts interested in the interface between the law and neuroscience.¹⁴ A range of subjects falls within its purview, from the extent to which neurological research affects understandings of freedom and responsibility to the possibilities through which the law can improve life

Dr. Aggarwal is a PGY-2 Resident in Psychiatry, Department of Psychiatry, Yale University, New Haven, CT. Address correspondence to: Neil K. Aggarwal, MD, MBA, MA, Department of Psychiatry, Yale University, 300 George Street, New Haven, CT 06511. E-mail: neil.k.aggarwal@gmail.com

for those affected by neurological injury.¹⁵ Recently, scholars of neurolaw have considered how functional neuroimaging affects the First Amendment right to privacy, the Fourth Amendment right against (mental) search and seizure, the Fifth Amendment right against self-incrimination, the possibility of introducing neuroimaging results as legal evidence, and the degree to which the legal system should adopt a more rehabilitative and less punitive approach to offenders.¹⁶ The 2005 Terry Schiavo case has stimulated inquiries into whether neuroimaging can resolve legal questions of life, death, diagnosis, and prognosis.¹⁷

This article begins with an appraisal of the neuroethics and neurolegal literature on the application of neuroimaging within the courtroom. Next, insights from medical anthropology and science and technology studies will show how conversations around functional neuroimaging reflect the self, mental illness, and medical expertise within the culture of American psychiatry. These reviews are meant to be representative, not exhaustive, given the volume of scholarly output in recent years. Finally, a discussion will be offered on how forensic psychiatrists can envision a new research agenda regarding neuroimaging. Forensic psychiatrists can contribute valuable observations given their roles within patient care¹⁸ and their familiarity with medicine and the law.

Neuroethics and Neurolegal Literature on Forensic Neuroimaging

Debates in neuroethics and neurolaw on the use of functional neuroimaging within the courtroom center on three main themes. First, the neuroimaging technology in its present state is poorly understood. Second, functional neuroimaging as an instrument cannot properly measure sociolegal values such as intentionality. Third, functional neuroimaging may subvert theories of individual agency with major consequences. Each point is elaborated in the following text.

Many have argued against functional neuroimaging in the forensic setting, since scientists do not fully understand how to evaluate its results. On the individual level, the discrete effects of multiple variables such as hormones, nutrition, activity, and medication on brain structure and function are unclear at the single moment at which the image is produced, let alone over time within a person.¹⁹ On the population level, the possible clinical significance of demographics such as age, race, and sex on results also

remains unknown.²⁰ Moreover, psychiatrists may not be suited to serving as expert witnesses, since they do not receive training on how brain images are constructed through complex, computerized algorithms.²¹ It is noteworthy that advocates of functional neuroimaging in legal settings concede the point that the technology may not be fully comprehended.

Others point out that functional neuroimaging is not designed to measure intentionality and may offer little help in forensic cases. For example, neuroscientists can explain the circumstances around which mechanical neural processes cause behavior, but they cannot address crucial legal questions on the presence of intentionality during a criminal act.²² In fact, some point to these limitations as ways of assuaging fears about the new technology. Because intentionality is a sociolegal value and not a region of the brain, there is little reason to assume that human reason would be supplanted by neuroimaging.^{23,24} The literature appears divided as to whether neuroimaging will replace human investigation in ascertaining intentionality.

Finally, functional neuroimaging reconfigures notions of agency with significant legal consequences. Emotions, identity, and freedom may suffer reductionism and determinism as the mind is reduced to brain regions and mental states are reduced to physical phenomena.^{25–28} As psychiatric disorders become characterized through abnormalities in brain structure and function, image deviations from established norms may affect legal arguments about the extent of free will in a criminal act.²⁹ In response, reductionistic models of the brain have been challenged on several grounds. Neuroimaging yields information about central nervous system function, not about personal responsibility.³⁰ Furthermore, demonstrations that a considerable degree of neural activity may be caused by variables outside our normal awareness do not entail that human beings lack agency.³¹ In addition, the fact that neuroscientists have reduced internal beliefs to an automatic, organic model of the brain does not disprove the existence of internal states or other models.³² Indeed, imaging studies are descriptive of physical states, not proofs of deterministic behavior.³³ Taken together, scholars disagree whether functional neuroimaging could undermine agency and responsibility.

This review reveals three areas of active contention around functional neuroimaging in the courtroom.

Supporters and detractors recognize the limitations in applying imaging for legal purposes, but they differ over the extent to which technology can or will explain the intentionality or agency of a criminal act in the future. These points of difference mirror broader cultural deliberations over the self, mental illness, and medical practice.

Selfhood, Mental Illness, and Medical Expertise in the Cultural Context

A close thematic reading of the literature on the ethics of functional neuroimaging demonstrates preoccupation over how the self, mental illness, and medical expertise are affected by newer technologies. In this section, these three domains are analyzed through critical theories from medical anthropology and science and technology studies. An estimation of implicit cultural assumptions may explain differences in opinion and offer areas for future research.

Within Anglo-American psychiatry, the brain often represents the self for purposes of medical and legal discourse. Medical and legal systems are cultural institutions based on values that may vary across societies.^{34,35} In Western cultures, the brain has symbolized selfhood and identity since the time of ancient Greek civilizations.^{36–38} From the 18th century, the brain has been the mediating focus between medicine and the law in the United States and the United Kingdom through psychiatry's cooperation with the state in policing and rehabilitation.^{39,40} Apprehensions exist as to whether neuroimaging will trace all aspects of behavior to the individual without attending to the real social, economic, and political factors that motivate criminals.⁴¹ In this context, claims about variations over brain structure and function understandably arouse sensitivities over identity and responsibility.

In addition, psychiatry has experienced dynamic paradigm shifts over the past 30 years. Since the 1980s, the biological model of the mind has increasingly supplanted the psychodynamic model as medical culture comes to valorize the "psychiatric scientist" who works with cutting-edge technologies, runs brain scans, and cultures cell lines.⁴² Functional neuroimaging falls within contemporary trends to advance biological theories of psychiatry. Imaging results allow patients to identify the physical components of mental illness, redefine their relationship with illness, and lobby for mental health par-

ity.⁴³ However, researchers raise alarms that the colorful images distract people from the multiple, complex variables involved in their production and that the clinical significance of abnormal findings remains unknown.⁴⁴ These exchanges on the technology and findings of neuroimaging encapsulate larger societal discussions about mental disorders as legitimate, physical illness.

Finally, neuroimaging provides a window into medical practice and authority. Medical technologies expose the micropolitics of physicians who contest each other by declaring expertise, consolidating identities, and marking subspecialty boundaries.⁴⁵ Expertise stems from social positioning and claims to specialized knowledge.⁴⁶ As biomedical technologies cross disciplinary lines from medicine into other realms, such as economics, defense, and business, meanings around normality and abnormality may adopt the reference points of neuroscience.⁴⁷ Considering that neuroimaging technologies require specialized training in operation and interpretation, assertions of expertise about the brain inevitably become medicalized, and questions arise as to who can speak authoritatively about the relationship between the brain and behavior narrowly within medicine and more generally within society.

Thus, the uncertainties and anxieties around legal applications of functional neuroimaging manifest larger cultural concerns about the self, mental illness, and medical expertise. An awareness of these concerns may allow psychiatrists to set terms for new discussions. The next section outlines areas for potential research.

Psychiatric Contributions to Forensics and Neuroimaging

Psychiatrists have recently pondered the use of functional neuroimaging for forensics purposes. Opinions vary from guarded endorsements that neuroimaging can inform common medico-legal questions^{48–50} to calls for more studies on the validity and reliability of results before its admission as evidence.^{51–54} These arguments resemble the neuroethical and neurolegal doubts over the adequate state of knowledge around imaging technologies, usually with the added aspect of the *Daubert* legal standards on scientific evidence. Even though this topic merits interest, forensic psychiatrists could propose other consequential topics on the social and cultural effects of neuroimaging.

The unique training of psychiatrists gives them a distinctive position to integrate multiple ideological frameworks. Psychiatrists learn the biopsychosocial model to assimilate significant, but disparate, variables that form the self. When that model is thoroughly implemented, psychiatrists can explore the multifaceted predispositions and treatments of their patients. The cultural formulation as recommended in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) furnishes an additional factor for rich information.⁵⁵ Forensic psychiatrists further dedicate themselves to working at the intersection of the legal and medical systems. This multidisciplinary foundation can lend versatility in their research methodologies, especially in light of the subjects previously discussed.

For example, forensic psychiatrists could assist in examining the relationship between the brain and selfhood. The questions of responsibility, competency, and treatment may take on new meanings for adolescent offenders if neuroimaging results can demonstrate how neuroplasticity affects cortical development and executive function. Interviews with offenders who have psychiatric histories could aid in understanding how neuroimages influence notions of insight, identity, and reform. From a wider perspective, forensic psychiatrists may best be able to articulate that identity and personality cannot be reduced to neural mechanisms with determined outcomes given the impact of psychology, society, religion, and culture on the individual.

In the same way, forensic psychiatrists could pioneer research into the effects of neuroimaging on conceptions of mental illness. Certain disorders such as drug addictions and paraphilias could be destigmatized if neuroimaging results can be shown to alter frontal–cortical function. Attorneys and juries could be interviewed on the extent to which neuroimaging results showing physical abnormalities influence perceptions around criminal responsibility. An ethics of involuntary treatment could be revisited if patients are shown to have clinically significant brain alterations that normalize with pharmacological intervention. Sentencing could be reconsidered on the basis of neuroimaging correlates of mental illness.

Also, forensic psychiatrists can return to the implications of medical authority in acting as expert witnesses in cases involving neuroimaging. Psychiatrists, neurologists, and neuroradiologists may mutually

benefit from interdisciplinary dialogues on how technologies depict the changes in brain structure and function that affect behavior, especially since forensic psychiatrists may be called to testify in this area. Training directors in psychiatry, and especially in forensic psychiatry, may deem it necessary to include specific education in neuroimaging so that trainees will critically grasp this growing research field. At the same time, psychiatrists can acknowledge their professional limits. Disciplines such as anthropology, philosophy, religion, and sociology retain their own intellectual histories and answer different questions about the self and human behavior. As we understand more about neuroimaging, we should explicitly state what the technology is designed to test and not test, remaining careful not to overstep our boundaries.

The recommendations set forth in this article have focused on the study of neuroimaging within American psychiatry, but cross-cultural comparisons could easily be initiated. Global forms of medical knowledge in such fields as clinical practice, technology, and bioethics often acquire local meanings.^{56–58} Clinical suggestions and practice guidelines that originate in the United States on the introduction of neuroimaging results into evidence may not be followed elsewhere, as the British and Indian examples show. These areas of divergence could represent avenues for future research. Substantial questions could be asked. To what extent does neuroimaging strengthen the biological models of the brain to the exclusion of others? Are ethnomedical conceptions of the brain lost throughout this process? How do people understand these social transformations and the medicalized claims of authority? How does imaging technology affect notions of mental illness? What sorts of legal precedents elsewhere allow for the admission of neuroimaging results as evidence? Perhaps most fundamentally, what are the ethics-related, legal, and social consequences if people refuse to submit to neuroimaging? These answers could disclose much about the practice of forensic psychiatry in the United States and in other contexts.

Conclusions

Debates on the use of neuroimaging in the courtroom occur around the state of current technology, its ability to measure intentionality and subsequent implications for agency. The literature can also be read for deeper cultural contestations around the na-

tures of the self, mental illness, and medical expertise. Psychiatrists can add to current discussions given their exposure to a broad array of biological, psychological, and social theories on illness. As the technology around neuroimaging becomes more defined and accepted, medical insights into identity and personality have increasing social, cultural, and legal consequences. The opposite process also occurs as social, cultural, and legal forces determine the extent to which medical discoveries assume authoritative stances. Forensic psychiatrists can use neuroimaging research to think critically about the self and illness, serving as interdisciplinary interlocutors, given their positions as medical professionals who interface with the legal system.

References

- Foster KR, Wolpe PR, Caplan AL: Bioethics and the brain. *IEEE Spectrum* 40:34–9, 2003
- Egan EA: Neuroimaging as evidence. *Am J Bioeth* 7:62–3, 2007
- Leapman B: Crooks may face ‘sci-fi’ brain scan. *The Daily Telegraph*. February 11, 2007. Available at <http://www.telegraph.co.uk/news/uknews/1542300/Crooks-may-face-%27sci-fi%27-brain-scan.html>. Accessed October 26, 2008
- Natu N: This brain test maps the truth. *The Times of India*. July 21, 2008, p 1
- Raghava M: Stop using brain mapping for investigation and as evidence. *The Hindu*. September 6, 2008, p 1
- Giridhardas A: India’s novel use of brain scans in courts is debated. *The New York Times*. September 15, 2008, p A10
- Illes J, Raffin TA: Neuroethics: an emerging new discipline in the study of brain and cognition. *Brain Cogn* 50:341–4, 2002
- Moreno JD: Neuroethics: an agenda for neuroscience and society. *Nat Rev Neurosci* 4:149–53, 2003
- Murphy ER, Illes J: Neuroethics and psychiatry: new collaborations for emerging challenges. *Psychiatr Ann* 37:798–804, 2007
- Levy N, Clarke S: Neuroethics and psychiatry. *Curr Opin Psychiatry* 21:568–71, 2008
- Knoppers BM: Neuroethics, new ethics? *Am J Bioeth* 5:33, 2005
- Greely H: On neuroethics. *Science* 318:533, 2007
- Vernillo A: Neuroethics is not hyperbole. *Am J Bioeth* 8:57–9, 2008
- Wolf SM: Neurolaw: the big question. *Am J Bioeth* 8:21–2, 2008
- Taylor JS: Neurolaw: towards a new medical jurisprudence. *Brain Inj* 9:745–51, 1995
- Tovino SA: Functional neuroimaging and the law: trends and directions for future scholarship. *Am J Bioeth* 7:44–56, 2007
- Fins JJ: The Orwellian threat to emerging neurodiagnostic technologies. *Am J Bioeth* 5:56–8, 2005
- Jones DG: Neuroethics: adrift from a clinical base. *Am J Bioeth* 8:49–50, 2008
- Zipursky RB: Imaging mental disorders in the 21st century. *Can J Psychiatry* 52:133–4, 2007
- Illes J: Neuroethics in a new era of neuroimaging. *Am J Neuroradiol* 24:1739–41, 2003
- Kulynych J: Brain, mind, and criminal behavior: neuroimages as scientific evidence. *Jurimetrics* 36:235–44, 1996
- Greene J, Cohen J: For the law, neuroscience changes nothing and everything. *Phil Trans R Soc Lond* 359:1775–85, 2004
- Gazzaniga MS, Steven MS: Neuroscience and the law. *Sci Am Mind* 16:42–9, 2005
- Buller T: Brains, lies, and psychological explanations, in *Neuroethics: Defining the Issues in Theory, Practice, and Policy*. Edited by Illes J. New York: Oxford University Press, 2006, pp 51–60
- Thompson SK: A brave new world of interrogation jurisprudence? *Am J Law Med* 33:341–57, 2007
- Jedlička P: Neuroethics, reductionism, and dualism. *Trends Cogn Sci* 9:172, 2005
- Farah MJ: Neuroethics: the practical and the philosophical. *Trends Cogn Sci* 9:34–40, 2005
- Schaffner KF: Neuroethics: reductionism, emergence, and decision-making capabilities, in *Neuroethics: Mapping the Field*. Edited by Marcus S. New York: The Dana Foundation, 2002, pp 27–33
- Tovino S: The impact of neuroscience on health law. *Neuroethics* 1:101–17, 2008
- Gazzaniga MS: Facts, fictions, and the future of neuroethics, in *Neuroethics: Defining the Issues in Theory, Practice, and Policy*. Edited by Illes J. New York: Oxford University Press, 2006, pp 141–8
- Morse SJ: Moral and legal responsibility and the new neuroscience, in *Neuroethics: Defining the Issues in Theory, Practice, and Policy*. Edited by Illes J. New York: Oxford University Press, 2006, pp 32–50
- Cho F, Squier RK: “He blinded me with science”: Science chauvinism in the study of religion. *J Am Acad Religion* 76:420–48, 2008
- Aharoni E, Funk C, Sinnott-Armstrong W, *et al*: Can neurological evidence help courts assess criminal responsibility? Lessons from law and neuroscience. *Ann N Y Acad Sci* 1124:145–60, 2008
- Kleinman A: *Rethinking Psychiatry: From Cultural Category to Personal Experience*. New York: The Free Press, 1988
- Kirmayer LJ, Rousseau C, Lashley M: The place of culture in forensic psychiatry. *J Am Acad Psychiatry Law* 35:98–102, 2007
- Doucet H: Imagining a neuroethics which would go further than genetics. *Am J Bioeth* 5:29–31, 2005
- Stoller SE, Wolpe PR: Emerging neurotechnologies for lie detection and the fifth amendment. *Am J Law Med* 33:359–75, 2007
- Illes J, Racine E, Kirschen MP: A picture is worth 1000 words, but which 1000?, in *Defining the Issues in Theory, Practice, and Policy*. Edited by Illes J. New York: Oxford University Press, 2006, pp 149–68
- Fabrega H: An ethnomedical perspective of Anglo-American psychiatry. *Am J Psychiatry* 146:588–96, 1989
- Foucault M: *Discipline and Punish*. New York: Vintage Books, 1995
- Arrigo BA: Punishment, freedom, and the culture of control: the case of brain imaging and the law. *Am J Law Med* 33:457–82, 2007
- Luhmann TM: *Of Two Minds: An Anthropologist Looks at American Psychiatry*. New York: Vintage Books, 2000
- Dumit J: A digital image of the category of the person: PET scanning and objective self-fashioning, in *Cyborgs and Citadels: Anthropological Interventions in Emerging Sciences and Technologies*. Edited by Downey GL, Dumit J. Santa Fe, NM: School of American Research Press, 1997
- Dumit J: *Picturing Personhood: Brain Scans and Biomedical Identity*. Princeton, NJ: Princeton University Press, 2004
- Simon CM: Images and image: technology and the social politics of revealing disorder in a North American Hospital. *Med Anthropol Q* 13:141–62, 1999
- Evans R, Collins H: Expertise: from attribute to attribution and back again?, in *The Handbook of Science and Technology Stud-*

Neuroimaging, Culture, and Forensic Psychiatry

- ies. Edited by Hackett EJ, Amsterdamska O, Lynch M, *et al.* Cambridge, MA: The MIT Press, 2008, pp 609–30
47. Hogle LF: Emerging medical technologies, in *The Handbook of Science and Technology Studies*. Edited by Hackett EJ, Amsterdamska O, Lynch M, *et al.* Cambridge, MA: The MIT Press, 2008, pp 841–74
 48. Silva JA: The relevance of neuroscience to forensic psychiatry. *J Am Acad Psychiatry Law* 35:6–9, 2007
 49. Simpson JR: Functional MRI lie detection: too good to be true? *J Am Acad Psychiatry Law* 36:491–8, 2008
 50. Wortzel HS, Filley CM, Anderson CA, *et al.*: Forensic applications of cerebral single photon emission computer tomography in mild traumatic brain injury. *J Am Acad Psychiatry Law* 36:310–22, 2008
 51. Appelbaum PS: The new lie detectors: neuroscience, deception, and the courts. *Psychiatr Serv* 58:460–2, 2007
 52. Langleben DD, Dattillio FM: Commentary: the future of forensic functional brain imaging. *J Am Acad Psychiatry Law* 36:502–4, 2008
 53. Granacher RP: Commentary: applications of functional neuroimaging to civil litigation of mild traumatic brain injury. *J Am Acad Psychiatry Law* 36:323–8, 2008
 54. Merikangas JR: Commentary: functional MRI lie detection. *J Am Acad Psychiatry Law* 36:499–501, 2008
 55. American Psychiatric Association: *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision*. Washington, DC: American Psychiatric Association, 2000, pp 897–8
 56. Good MJDV: Cultural studies for biomedicine: an agenda for research. *Soc Sci Med* 41:461–73, 1995
 57. Jasanoff S: Making order: law and science in action, in *The Handbook of Science and Technology Studies*. Edited by Hackett EJ, Amsterdamska O, Lynch M, *et al.* Cambridge, MA: The MIT Press, 2008, pp 761–86
 58. Lock M: Biomedical technologies, cultural horizons, and contested boundaries, in *The Handbook of Science and Technology Studies*. Edited by Hackett EJ, Amsterdamska O, Lynch M, *et al.* Cambridge, MA: The MIT Press, 2008, pp 875–900