CAN'T GET YOU OUT OF MY HEAD:
The Human Rights Implications of Using Brain Scans as Criminal Evidence

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On June 12, 2008, Aditi Sharma was convicted by a court in the Indian state of Maharashtra for the murder of her former fiancé, Udit Bharati. Sharma had lived with Bharati in the city of Pune before leaving him for another man. Prosecutors argued that Sharma subsequently returned to Pune and asked Bharati to meet her at a McDonald's restaurant where she poisoned him with arsenic-laced food.[1]

Sharma's conviction marked the dawn of a new era for the use of scientific evidence in criminal prosecutions. For the first time, a brain scan[2] was relied on as evidence of a criminal defendant's guilt.[3] The court found that the scan proved that Sharma had "experiential knowledge" of having murdered Bharati herself, as opposed to even hearing details of his murder from another person.[4] Essentially, the scan was accepted as scientific proof of Sharma's own memory.

While the validity of the use of brain scans to prove experiential knowledge is still contested by many researchers,[5] the implications of the Sharma case are nonetheless significant. Brain scan technology could potentially offer investigators the ability to peer inside the mind of every criminal defendant. Although Sharma consented to the brain scan in her case, it seems inevitable that investigators will eventually seek to perform such tests on non-consenting suspects, arguing that a brain scan is simply biological evidence no different than a blood test or fingerprinting.

This article analyzes the use of non-consensual brain scans purporting to show the presence or absence of memory of an event under the civil liberties guarantees of international law. It begins with an overview of brain scan technology and its potential use in criminal prosecutions. It then considers the arguments against the use of such evidence in this context. Finally, it draws conclusions as to the legality of the use of brain scan evidence under prevailing human rights norms.

I. THE SCIENCE AND USES OF BRAIN SCAN TECHNOLOGY

Law enforcement officials have long used science as a tool when seeking convincing evidence of a defendant's guilt. In the late 19th century, British authorities, working under the novel theory that no two fingerprints were alike, began using

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[1] Anand Giridharadas, *India's Novel Use of Brain Scans in Court is Debated*, N.Y. TIMES, 15 Sep. 2008, at A10.

[2] The generic term "brain scan" will be used in this article to describe various techniques which measure brain activity.

[3] A brain scan offered in a 2006 case in the Indian state of Gujarat was found to corroborate other evidence, but was not deemed to be conclusive proof by the court. Giridharadas, *supra* note 1, at A10.

[4] Angela Saini, *The Brain Police: Judging Murder with an MRI*, WIRED, 9 June 2009, available at www.wired.co.uk/wired-magazine/archive/2009/05/features/guilty.aspx. Sharma has lodged an appeal and was released on bail in early 2009. *Id.*

[5] In fact, a 2008 report by India's National Institute of Mental Health and Neuro Sciences declared the use of brain scans in criminal cases to be unscientific. Naveen Ammembala, *Panel Debunks Brain-Mapping*, EXPRESS BUZZ, 13 Nov. 2008, available at www.expressbuzz.com.

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fingerprints as a means of identifying repeat offenders.[6] Soon after, a fingerprint was used as evidence to identify the perpetrator in a criminal investigation.[7] By the early 20th century, the use of fingerprint evidence had become widespread.

The use of scientific evidence proliferated throughout the 20th century. Evidence related to hair, breath, blood and other bodily fluids, dental records, and firearms is routinely used to attempt to connect a defendant to a particular crime. Most recently, DNA testing has allowed for an unparalleled level of accuracy in comparing biological samples.[8]

Valuable as these methods are, they may not provide a sufficient level of proof to sustain a conviction and are often dependant on the discovery and preservation of some physical specimen. Thus, criminal investigators have long sought a means of using science to more directly prove a person's guilt by showing the existence of a physiological response confirming the person's own personal knowledge that he or she committed a crime. The most notorious result of this effort is the polygraph examination, a method that has yielded mixed results at best.

The polygraph, which dates to the early 20th century, measures alterations in breathing, blood pressure, and perspiration as indicators of deception.[9] From the start, questions regarding the reliability of the polygraph were an obstacle to its admissibility in judicial proceedings. In 1998, the United States Supreme Court observed that after nearly a century of existence, there was "simply no consensus that polygraph evidence is reliable."[10] As a result, the results of polygraph examinations are typically not admissible against a non-consenting criminal defendant in most of the world's jurisdictions.[11]

The development of new technology that purports to more accurately reveal deception has therefore long been sought for application as a law enforcement tool. Recent advances in neurotechnology have made brain scans—a generic term for techniques that measure brain activity—a promising candidate to fit this bill. Two methods of measuring brain activity have risen to the forefront in discussions regarding the use of brain scans to detect untruthfulness.

The first method, known as Functional Magnetic Resonance Imaging (fMRI), measures brain activity by creating magnetic images of blood oxygen in the brain. Areas of the brain that are active use more blood and, as a result, show up brighter when imaged.[12] Computer software is then used to create a color-coded three-

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[6] Simon A. Cole, SUSPECT IDENTITIES, A HISTORY OF FINGERPRINTING AND CRIMINAL IDENTIFICATION 86-88 (2001).

[7] *Id.* at 88-89. Coincidentally, the first use of fingerprint evidence in a criminal trial occurred during a murder trial in India. *Id.*

[8] *See* Julie A. Singer, Monica K. Miller, and Meera Adya, *The Impact of DNA and Other Technology on the Criminal Justice System: Improvements and Complications*, 17 ALB. L.J. SCI. & TECH. 87 (2007).

[9] Joseph H. Baskin, Judith G. Edersheim, & Bruce H. Price, *Is a Picture Worth a Thousand Words? Neuroimaging in the Courtroom*, 33 AM. J. L. & MED. 239, 265 (2007).

[10] United States v. Scheffer, 523 U.S. 303, 310 (1998).

[11] Polygraph evidence may, however, be admissible in some situations, such as when the defendant and prosecutor have agreed to its admissibility. Even in jurisdictions where they are inadmissible in court, polygraphs are often widely used in criminal investigations and by the private sector. One study reports that over 40,000 polygraph examinations are conducted each year in the United States despite questions about the exam's reliability and its general inadmissibility in court. Baskin et al., *supra* note 6, at 265.

[12] Matthew Holloway, *One Image, One Thousand Incriminating Words: Images of Brain Activity and the Privilege against Self-Incrimination*, 27 TEMP. J. SCI. TECH. & ENVTL. L. 141, 144-50 (2008).

dimensional map of brain activity.[13] The location of this activity is then associated with specific cognitive functions, allowing a researcher to infer, for example, whether a stimulus is familiar or unfamiliar to the subject.[14] The first major study considering the applicability of fMRI technology to lie detection was published by University of Pennsylvania researchers in 2002,[15] and the technology is now being promoted commercially.[16]

The second method measures the brain's electrical activity using electroencephalographic (EEG) sensors placed on the head. Researchers compare brain activity for stimuli, which are known to be familiar or unfamiliar to the subject. New stimuli are then presented and compared to these baselines to determine whether they are familiar or unfamiliar to the subject.[17]

The movement to apply the EEG method in lie detection was led by American researcher Dr. Lawrence Farwell, who now markets the technology as "Brain Fingerprinting."[18] The brain scan used in the Sharma case in India has been described as derivative of Farwell's Brain Fingerprinting.[19] Known as Brain Electrical Oscillations Signature test (BEOS), the process was developed by Champadi Raman Mukundan, former director of the clinical psychology department the National Institute of Mental Health and Neuro Sciences, located in Bangalore.[20]

Numerous methods exist to determine truthfulness using these two methods of brain scan. First, the brain activity can be measured when the subject is asked to actively respond to a statement (i.e., reply "yes" or "no" to a question). Second, researchers can measure the subject's passive perception (ie, subject is not asked to respond but is shown images or read statements). Finally, the subject could be presented with images so briefly that they are only subconsciously processed.[21] In the end, however, the goal is the same: to demonstrate experiential knowledge of an event that only the perpetrator would have access to.

To date, the use of such brain scan technology in connection with criminal cases has been limited. Aside from India's use of consensual testing,[22] it does not appear that the technology has been used as evidence against criminal defendants at trial. While results of fMRIs have been admitted in United States courts, this has been done on behalf of defendants seeking to mitigate culpability following conviction.[23] Brain Fingerprinting has also been admitted in the post-conviction context

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[13] *Id.*

[14] *Id.*

[15] *See* Daniel Langleben, et al., *Brian Activity During Simulated Deception: An Event-Related Functional Magnetic Resonance Study*, 15 NEUROIMAGE 727, 727 (2002).

[16] The product is marketed as "No Lie MRI." *See* www.noliemri.com. The product's website states that "Current accuracy is over 90% and is estimated to be 99% once product development is complete." *See* www.noliemri.com/products/Overview.htm.

[17] Mark Pettit, Jr., *FMRI and BF Meet FRE: Brain Imaging and the Federal Rules of Evidence*, 33 AM. J. L. & MED. 319, 321 (2007).

[18] *See* www.brainfingerprinting.com.

[19] Giridharadas, *supra* note 1, at A10.

[20] *Id.*

[21] Holloway, *supra* note 12, at 151-53.

[22] Two additional murder convictions were secured using BEOS technology in India after Sharma's conviction. As of mid-2009, approximately 80 BEOS tests had been conducted in criminal cases in India, and ten of those resulted in confessions. Saini, *supra* note 4.

[23] Reyhan Harmanci, *Complex Brain Imaging is Making Waves in Court*, S.F. CHRONICLE, 17 Oct. 2008, at A1. Experts believe that the U.S. Supreme Court was influenced by fMRI evidence in its landmark decision holding the execution of minors to be unconstitutional. *Id. See* Roper v. Simmons, 543 U.S. 551 (2005).

in at least one United States jurisdiction, although the results were not persuasive.[24]

Despite its meager impact so far, the potential of brain scan technology has captured the interest of a number of parties. Both Israel and Singapore have reportedly been evaluating India's experience with EEG testing in criminal investigations.[25] Additional facilities are being opened in India, and companies are seeking to gain a footing in the British criminal justice system as well.[26]

In addition, intelligence agencies are exploring the possible application of brain scan technology to counterterrorism work.[27] The United States government is reported to have "plowed money into brain-based lie detection in the hope of producing more fruitful counterterrorism investigations."[28] A 2008 report by the United States National Research Council noted that "this emergent technology might provide insight into . . . the acquisition of intelligence from captured unlawful combatants" and "the screening of terrorism suspects."[29] At least one anonymous source within the American intelligence community has indicated that brain scans are already being employed in this fashion.[30]

II. CHALLENGES TO THE ADMISSIBILITY OF BRAIN SCANS AGAINST CRIMINAL DEFENDANTS

The potential uses of brain scan technology are wide-ranging. This section, however, limits itself to analyzing the human rights implications of using fMRI or EEG evidence without the consent of a criminal defendant as proof that he or she has experiential knowledge of a crime and, therefore, must have committed the crime. It examines the two human rights arguments that might be advanced with regard to the use of brain scans in this context. First, it considers the merits of arguments based on the scientific validity of brain scans, and then analyzes the use of brain scans in light of the right not to be compelled to testify against oneself.

A. Scientific Validity

No consensus exists on the reliability of brain scans in detecting lies. India's use of the BEOS test in the Sharma case was met with skepticism by many re-

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[24] In 2001, Brain Fingerprinting evidence was admitted in a district court in the State of Iowa in support of a post-conviction claim of innocence. The district court was apparently not persuaded by the evidence and upheld the conviction, only to be reversed by the Iowa Supreme Court. Although its promoters boast that Brain Fingerprinting testing aided in the appeal, the Iowa Supreme Court gave "no further consideration" to the evidence and instead reversed the defendant's conviction on other grounds. Harrington v. State, 659 N.W.2d 509, 516 (Iowa 2003).

[25] Giridharadas, *supra* note 1, at A10.

[26] Saini, *supra* note 4.

[27] *See, e.g.*, INTELLIGENCE SCI. BD., EDUCING INFORMATION—INTERROGATION: SCIENCE AND ART—FOUNDATIONS FOR THE FUTURE 63-93 (2006), available at www.fas.org/irp/dni/educing.pdf.

[28] *Id.*

[29] National Research Council, EMERGING COGNITIVE NEUROSCIENCE AND RELATED TECHNOLOGIES 52 (2008).

[30] Jonathan H. Marks, *Interrogational Neuroimaging in Counterterrorism: A "No-Brainer" or a Human Rights Hazard?*, 33 AM. J. L. & MED. 483, 490 (2007). Marks quotes unpublished correspondence from an American intelligence officer stating that MRI scans and EEG tests have been used in the screening of terrorist suspects. The officer reports "great results" from a process developed by neuro-psychologists at London's University College and the Israeli intelligence organization Mossad. *Id.*

searchers. "Technologies which are neither seriously peer-reviewed nor independently replicated are not, in my opinion, credible," said Dr. J. Peter Rosenfeld of Northwestern University, one of the researchers involved in the early development of such techniques.[31] Dr. Michael Gazzaniga and several colleagues at University of California, Santa Barbara, concluded that the BEOS technology is "shaky at best."[32] At the same time, others consider the results of the test convincing, with one British expert, Keith Ashcroft, stating that the test has "demonstrated its utility in providing admissible evidence" use to secure convictions.[33] In most jurisdictions, some level of reliability must be shown before such scientific evidence can be admitted. Thus, serious doubts regarding the validity of a particular scientific procedure should foreclose admissibility of that evidence. This lack of consensus may be the reason that at present, BEOS tests are not admissible in India unless the defendant consents to the test.

There are no express provisions in the major international human rights instruments regarding the admissibility of scientific evidence. However, each does contain the guarantee to a fair trial.[34] The use of unreliable scientific evidence is arguably a contravention of these provisions. At the present time, a convincing argument might be made that brain scans are not adequately reliable and that their use would therefore violate the right to a fair trial.

This strength of this argument may fade, however, as advances in neurotechnology, supported by peer-reviewed research, enhance the reliability of the brain scan as a method of showing experiential knowledge. Moreover, it is worth noting that courts have long been willing to accept new scientific evidence that has not yet been subjected to, or might not even survive, vetting within the scientific community.[35] Given these considerations, it is possible that brain scans could clear this first hurdle of scientific validity in the near future. Even if brain scans are found to be wholly reliable, however, there is an additional human rights protection that might prevent their use against a defendant in a criminal trial.

B. The Guarantee against Self-Incrimination

Even if non-consensual brain scan evidence showing experiential knowledge of a crime is scientifically sound, it may run afoul another fair trial guarantee found in international human rights law: the guarantee against self-incrimination. The International Covenant on Civil and Political Rights and the American Convention on Human Rights both expressly guarantee this right.[36] Further, although it is not expressly guaranteed in the European Convention on Human Rights, the European Court of Human Rights has found that it is implicitly guaranteed as part of the right to a fair trial.[37]

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[31] *Id.*

[32] *Id.*

[33] Giridharadas, *supra* note 1, at A10.

[34] ICCPR art. 14(1); ECHR art. 6(1); ACHR art. 8(1).

[35] Peter W. Huber, GALILEO'S REVENGE: JUNK SCIENCE IN THE COURTROOM 2 (1991). This phenomenon is particularly troublesome in common law jurisdictions which rely on adversarial proceedings to determine the reliability of particular scientific assays. A recent report issued by the National Academy of Sciences, a Congressionally-mandated advisory body in the United States, observed that "[t]he adversarial process relating to the admission and exclusion of scientific evidence is not suited to the task of finding 'scientific truth.'" National Academy of Sciences, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD, S-9 (2009).

[36] ICCPR art. 14(2)(g); ACHR art. 8(2)(7).

[37] Jalloh v. Germany (2006) 44 EHRR 667 at ¶¶ 110-11.

The question then becomes whether the guarantee against self-incrimination is violated by subjecting a person to a non-consensual brain scan to determine whether he or she has experiential knowledge of a particular crime. While asking a defendant for responses to questions while conducting a scan would clearly seem to violate this principle, the answer is less obvious in a situation where a brain scan tracks subconscious or passive perceptions to photos or statements but the defendant remains silent. In this situation, one could argue that the brain scan is nothing more than another observation or sample of the defendant's physical being, no different than taking a blood sample, fingerprint, buccal swab, or even photo of the individual.[38]

It is then necessary to consider the manner in which the guarantee against self-incrimination has been interpreted. The Human Rights Committee, in General Comment 13, has emphasized that the accused may not be compelled to testify against himself or herself, and any form of compulsion is "wholly unacceptable."[39] It would seem to flow from this that if a person's experiential knowledge, or memory, is tantamount to "testimony," then it cannot be used against a defendant absent his or her agreement.

The European Court of Human Rights is instructive in this regard. In *Jalloh v. Germany*[40] the Court noted that compulsory powers may be used to secure "real" evidence which has an "existence independent of the will of the suspect."[41] Breath, blood, urine, and bodily tissue samples are examples of such "real" evidence that can be used in criminal proceedings.[42]

On the other hand, it is clear that an involuntary confession violates the right against self-incrimination. Moreover, the Court has held that the guarantee against self-incrimination extends to forcing a defendant to disclose documents which might provide evidence of crimes, even though such documents are real evidence.[43] Here, it appears that the Court draws a distinction between strictly physical real evidence and real evidence that reflects a defendant's thought processes, because the latter's existence is not truly independent of the will of the suspect. Finally, the court has considered the invasiveness of the method used to secure evidence as a relevant factor in its self-incrimination analysis.[44]

These considerations favor the conclusion that experiential knowledge, or memory, is subject to the privilege against self-incrimination. The strongest argument in favor of this conclusion is that a person's thoughts, including memory, should be viewed as a part of the person's will. It is reasonable to predict that a court would determine that memory does not have an independent existence from the individual in the way that blood or tissue samples do.[45]

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[38] The use of the commercial name "Brain Fingerprinting" could be seen as an attempt to characterize this type of brain scan technology as a non-invasive measurement of a physical sample.

[39] General Comment 13 (13 Apr. 1984).

[40] (2006) 44 EHRR 667.

[41] *Id.* at 110, 112.

[42] *Id.* at 112.

[43] *Id.* at 111.

[44] *Id.* at 117-18.

[45] It is, of course, possible that scientific advances could change this assumption. A 1999 article noted that neuroimaging presented "metaphysical questions" about the nature of a person's brain state. *Functional Brain Imaging: Twenty-First Century Prenology or Psychobiological Advance for the Millenium?*, 156 AM. J. PSYCHIATRY 671 (1999). However, it is difficult to imagine courts holding as a matter of law that a person's thoughts are not part of that person's will, short of a real-world equivalent of Professor Albus Dumbledore's *pensieve*, where "one simply siphons off the excess thoughts from one's mind, pours them into the ba-

The fact that memory reflects a person's record of their own experiences is also significant. It is more than simply a physical process, but is a product of subjective interpretation and individual cognitive limitations. In this way, it is more similar to those personal documents that are protected by the guarantee against self-incrimination than to physical samples, which are not.

Finally, the European Court has considered the intrusiveness of a method in determining its permissibility. The method employed in a brain scan—literally looking inside someone's mind—would appear to be the height of invasiveness. As Stanford University bioethicist Hank Greely notes, the successful development of brain scans as lie detection tools would invade "a last inviolate area of self."[46] Even absent other considerations, it is likely that brain scans employed in lie detection could run afoul of international human rights standards given the highly intrusive nature of the process.

III. CONCLUSION

This article argues that even if brain scan evidence is admissible as scientific evidence, it should be inadmissible as violating the principle against self-incrimination in those cases where the scan is conducted without the consent of the defendant, even if the procedure does not require responses from the defendant. This would not, of course, change the outcome of the Sharma case since the brain scan in that case was conducted with the defendant's consent. However, a clear understanding that such procedures are inadmissible when non-consensual is important in preventing future defendants from feeling compelled to voluntarily submit to tests as part of an investigation.

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sin, and examines them at one's leisure." J.K. Rowling, HARRY POTTER AND THE GOBLET OF FIRE 597 (2000).

[46] Hank Greely, *The Social Effects of Advances in Neuroscience: Legal Problems, Legal Perspectives,* in Judy Illes (ed.), NEUROETHICS: DEFINING THE ISSUES IN THEORY, PRACTICE AND POLICY 245 (2005).