Misinterpretation of Significance of New Brain Technologies Has Legal and Ethical Implications

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A September 7 article in the N.Y. Times reported the results of a study published in the journal Science on “Detecting Awareness in the Vegetative State.” The authors of the study utilized functional magnetic resonance imaging (“fMRI”) to measure the neural responses of a patient in a persistent vegetative state (“PVS”) to spoken sentences. “In response to commands, the patient’s brain flared with activity, lighting the same language and planning regions that are active when health people hear the commands.”

Even though the study was conducted on only one patient, it is significant because it constitutes some evidence that some patients in a PVS may be responsive to external stimuli. Of course, there are numerous limitations to this study. It was conducted only on a single patient, who was unable to communicate with the researchers, and the study “did not mean that unresponsive brain-damaged people were more likely to recover or treatment was possible.” In addition, the brain damage suffered by the patient in the study was not as profound as is found in some PVS cases (like Terri Schiavo’s, for one).

However, the N.Y. Times article quotes Dr. Nicholas Schiff, a neuroscientist at Weill Cornell Medical College, for the conclusion that “the study provided ‘knock-down, drag-out’ evidence for conscious activity . . . .” I disagree with Dr. Schiff on this point, and the reason I disagree has to do with the nature of fMRI technology. fMRI technology measures blood oxygenation levels in various areas of the brain. When some kind of stimulus is presented, fMRI technology can demonstrate whether blood oxygenation levels increase in areas of the brain that we would associate with certain kinds of brain activity. Thus, if the fMRI technician plays Beethoven’s Ninth Symphony, one might expect the fMRI scan to show heightened blood oxygenation levels in the temporal lobe, which is one part of the brain that is associated with musical capacity.

The key, however, lies in understanding in the above example that fMRI scans are not literally equivalent to the experience of hearing music. fMRI measures what are termed

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2 Owen, supra note 1, at 1402.
3 Carey, supra note 1, at A1.
4 Id.
5 Id.
6 Id.
neural correlates, and the word “correlate” makes all the difference. Blood oxygenation levels are unquestionably indirect ways of measuring brain activity. fMRI scans measure the correlation between a given stimulus and blood oxygenation level. But it does not follow that fMRI scans therefore measure the subject’s actual experience in response to the stimulus. Scientists think, quite reasonably, that blood oxygenation level is correlated with brain activity, but the extent and the precise features of that correlation are both extremely complicated and as yet poorly understood.

One set of commentators identify several species of “neurofallacies,” one of which, “neuro-realism,” reflects the uncritical way in which an fMRI investigation can be taken as validation or invalidation of our ordinary view of the world. Neuro-realism is, therefore, grounded in the belief that fMRI enables us to capture a ‘visual proof’ of brain activity, despite the enormous complexities of data acquisition and image processing.

Thus, a host of assumptions and inferences would be needed to move from the premise that fMRI scans on the patient in the cited study show increased blood oxygenation levels in areas of the brain that we correlate with “speech-specific activity” to the conclusion that these neural correlates are “knock-down, drag-out” proof of consciousness. Blood oxygenation levels are absolutely not equivalent to the actual experience of consciousness, or, at the very least, much argument and theory would need to be deployed to justify such a contention. Neural correlates are just that – correlates, and cannot reasonably be said to be equivalent to the experience of consciousness itself. Nor is such a conclusion even necessary to find the results of the study quite significant; the mere fact that neural correlates of consciousness seem to exist in a patient in a PVS is extremely important even if that fact is not literally proof of consciousness.

On the Neuroethics & Law Weblog, Neil Levy, a philosopher who is involved in work on neuroethics, also takes issue with Dr. Schiff’s conclusion, noting that

we do not – yet – know what counts as evidence for the presence of consciousness, but . . . we do know that evidence of processing is not

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9 See, e.g., Rüdiger Vaas, Why Neural Correlates of Consciousness are Fine, but Not Enough, 2 ANTHROPOLOGY & PHIL. 121 (1999).
10 See, e.g., Timothy Q. Duong et al., Localized Cerebral Blood Flow Response at Submillimeter Columnar Resolution, 98 PROC. NAT’L. ACAD. SCI. 10904, 10904 (2001) (explaining that, as to fMRI, “the response function of the stimulus-evoked hemodynamic response remains poorly understood”).
11 See generally Eric Racine, Ofek Bar-Ilan, & Judy Illes, fMRI in the Public Eye, 6 NAT. REVIEWS NEUROSCIENCE 159, 161 (2005).
12 Id. at 160.
13 Owen et al., supra note 1, at 1402.
14 Carey, supra note 1, at A1.
15 John Searle, in his important book, The Rediscovery of Mind, adopts as his central thesis the rejection of the dichotomy between physical materialism and subjectivity as to consciousness. That is, Searle contends both that without a neurophysiological substrate there is no consciousness and that such a substrate is not in and of itself equivalent to the subjective experience of consciousness.
evidence of consciousness. We already know that subjects who are, by most standard tests, unconscious engage in processing that is sensitive to the content of sounds they hear. Consider people in a state of automatism. They are able to engage in very complex series of actions, even driving cars while avoiding obstacles and obeying traffic signals. So long as the action is routine, they are capable of engaging in it.\textsuperscript{16}

Racine et al. note the profligacy of neurofallacies in media coverage of fMRI technology.\textsuperscript{17} The prevalence of such fallacies may result in profound legal consequences. For one, the use of fMRI raises important concerns of privacy and confidentiality. As to the latter, several questions arise at the outset:

First, do existing confidentiality protections apply to the growing number of scientists who create, use, and disclose neuroimaging information? Second, do existing protections apply to neuroimaging information that is interpreted to reveal social qualities and characteristics, but not particular physical or mental conditions? Third, when is neuroimaging information individually identifiable? Finally, how can scientists disclose neuroimaging information to neuroimaging databanks in accordance with publication requirements and peer suggestion without violating confidentiality requirements?\textsuperscript{18}

The fact that some have suggested that functional neuroimaging technologies can be used to determine whether an individual is lying, or “could unveil racial preferences and prejudices”\textsuperscript{19} raises serious concerns about confidentiality and privacy. Moreover, such technologies have the potential to alter the basic conception of what it is that qualifies as lying or prejudice, with attendant consequences in criminal and civil law.

Second, Racine et al. identify concerns of “neuro-policy” that seem to attend beliefs about the significance of fMRI. They note, for example, that “the Lighted Candle Society, a Utah-based non-profit organization that is dedicated to the enhancement of moral values, advocates the use of fMRI to prove that pornography is addictive.”\textsuperscript{20} Given the novelty of so much functional neuroimaging technologies, the potential policy implications are diverse and numerous.

The key lies in understanding that the legal and ethical concerns regarding fMRI are largely contingent on what meanings are attached to those technologies. One who believes that fMRI literally shows the actual experience of music appreciation, of lying, or of consciousness are likely to have very different perspectives on the legal and ethical implications of fMRI than one who understands that measurement of neural correlates is

\textsuperscript{17} Racine et al., \textit{supra} note 10, at 160-63.
\textsuperscript{19} \textit{Id.} at 845.
\textsuperscript{20} Racine et al., \textit{supra} note 10, at 161.
not equivalent to proof of the actual, subjective experience that is supposedly being assessed. Accordingly, careful analysis and greater reflectivity on both the nature of the new brain technologies and the nature of consciousness will be invaluable tools in assessing the questions of neuroethics that pervade new brain technologies.

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