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Peer Commentary

Neuroscience or neurospeculation? Peer commentary on four articles examining the prevalence of neuroscience in criminal cases around the world

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INTRODUCTION

There is a certain allure to neuroscience. It is easy to understand why a field that seeks to understand the intricacies of the human mind has such wide appeal. The widespread use of neuro- as the 'prefix du jour' would suggest that there is also a general belief that neuroscientific approaches to old problems hold the promise of new answers.

The law has not been exempt from this promise. Quite the opposite, the potential for neuroscience to provide new answers to the legal problems has generated substantial and widespread excitement. This is evident in the sharp rise in conceptual and empirical scholarship on the subject, the proliferation of national and international conferences, and the investment of tens of millions of dollars by public and private entities fueling interdisciplinary research to develop this field.[1]

This collective excitement is easy to understand. As long as there have been laws, fact-finders have struggled to answer critical questions when applying those laws to individual cases. In a previous article summarizing the field of neuroscience and law, I provided some examples: Was the defendant responsible? What did the defendant intend? How competent is the individual to stand trial? Is this witness lying? What capacity did the defendant have to act differently? And will the person be a repeat offender?[2] The accurate adjudication of each of these questions is essential for the just application of

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1 Francis X. Shen, *The Law and Neuroscience Bibliography: Navigating the Emerging Field of Neurolaw*, 38 Int'l J. Legal Info. 352 (2010).

2 Owen D. Jones & Matthew Ginther, *Law and Neuroscience*, in International Encyclopedia of the Social & Behavioral Sciences 489, 490 (Neil J. Smelser and Paul B. Baltes ed., 2d ed. 2015).

the law. But we still rely, to varying degrees, on legal fact-finders to answer each question based largely on their capacity to act as amateur mind-readers. Thus, it is hardly surprising that the field of neuroscience can appear to be the silver bullet for the most vexing problems that the law presents. Perhaps, the thinking goes, structural or functional brain measures can aid judgments about whether someone is lying, responsible, or even likely to recidivate. And because of the nature of the science, we can feel confident that, for once, these conclusions are based on objective and quantifiable data.

At the same time, it is necessary to ask whether these advancements in neuroscience have actually begun to have practical use. While anecdotal evidence exists, there has been little empirical work examining the actual prevalence of neuroscience in legal adjudications. The four pieces published over the last 2 years in the *Journal of Law and Biosciences* sought to address that problem in four different jurisdictions: the USA,[3] Canada,[4] the Netherlands,[5] and England and Wales.[6] Each article concludes that the use of neuroscience in the courts of each respective jurisdiction is increasing at a relatively rapid pace. However, my review of their methods and results leads me to a different conclusion: there is no evidence supporting the conclusion that neuroscience is yet being introduced in trial courts, in any meaningful quantity.

The divergence in opinion rests not on semantics, but on what I think is a widespread misclassification of analyses or opinions using neuroimaging and 'neurojargon' as constituting neuroscience. I believe that in these four articles the authors have made this same common mistake by implicitly classifying evidence as neuroscience so long as the experts providing the evidence couched their opinions with a focus on specific brain systems or purported to base their opinions on brain images. In this commentary I will address the nature of this misclassification and why it is so widespread. I will also discuss why it is problematic in light of our collective experience with the field of forensic psychology. Finally, I briefly describe what actual neuroscience in the courts does look like, to the extent is has already been introduced.

KEEPING THE SCIENCE IN NEUROSCIENCE

In a world of increasing specialization, the number of scientific disciplines seems to increase every day. However, there is a central tenet that underlies all of science: the requirement that knowledge be based on systemic observations of the world that result in predictions that can be tested and falsified. This focus on empiricism is the defining feature of the scientific method, and it is what allows scientists to differentiate between scientific knowledge and mere conjecture, opinion, and speculation. This is not to say that conjecture, opinion, and speculation cannot help the scientific process advance, but that every scientist worth her salt can differentiate between the two and guards the line zealously.

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[3] Nita A. Farahany, *Neuroscience and Behavioral Genetics in Us Criminal Law: An Empirical Analysis*, 2 J. L. Biosci. 485 (2015).

[4] Jennifer A. Chandler, *The Use of Neuroscientific Evidence in Canadian Criminal Proceedings*, 2 J. L. Biosci. 550 (2015).

[5] C.H. de Kogel & E.J.M.C. Westgeest, *Neuroscientific and Behavioral Genetic Information in Criminal Cases in the Netherlands*, 2 J. L. Biosci. 580 (2015).

[6] Paul Catley & Lisa Claydon, *The Use of Neuroscientific Evidence in the Courtroom By Those Accused Of Criminal Offenses in England and Wales*, 2 J. L. Biosci. 510 (2015).

A common misunderstanding about science is that it results from the use of technologically advanced techniques. This misunderstanding, in my opinion, drives a great deal of confusion about what science is all about. Advanced technology is often used to assist scientists and is often developed by scientists. But the use of advanced technology is akin to the use of a word processor; it is a tool that assists the work scientists do, but is orthogonal to the concept and demands of scientific discovery itself. To be sure, this is not a misunderstanding that is only held by laypersons. Even scientists often become complacent in their application of the scientific method when advanced—some might say 'sexy'—technologies are used. For example, it is well known that studies in the early years of fMRI research were plagued with basic mistakes in scientific inference.[7] Despite being peer-reviewed, these methodological mistakes were, by most people's understanding, elementary even at the time.

The contrast between the use of science and the use of technology figures prominently in the four *Journal of Law and the Biosciences* studies. The methods employed—which were largely homogenous across the studies—did not isolate cases where neuroscience was introduced insomuch as they isolated cases where brain imaging technology or neurojargon was used. Each study defined a case as 'involving neuroscience' if it contained at least one of a family of key words, such as Brain, EEG, fMRI, and CT Scan. No study examined whether the use of these technologies was consistent with the rigors of the scientific method, or in other words, actually constituted 'neuroscience'. The commentary of at least one author suggests that this determination was based on the belief that the use of a brain scan is indisputably sufficient to conclude that the evidence is neuroscientific in nature: 'Brain scan evidence might be accepted by all or virtually all commentators as being neuroscientific evidence.'[8] But this conclusion is far from obvious. By itself, a brain scan is no more scientific than the careful measurements of the bumps on an individual's skull—a practice called phrenology that was once considered cutting edge brain science, but now widely considered bizarre.

Even though these studies' search methods did not target evidence having scientific rigor, it is certainly possible that the identified cases were based on science nonetheless. It is impossible for me to examine all the cases identified, since only a few representative cases are presented in the manuscripts. However, a cursory examination of these representative cases provides no indication that the technology was used with anything approaching the demands of scientific inference. In the article examining English and Welsh courts, the authors describe testimony of a Dr Reeves, who links a defendant's childhood head injury to his behavior as an adult. That testimony concludes that the childhood injury may have caused damage to the defendant's temporal lobe—the part of the brain, the doctor claims, that governs temper control and learning. The article examining the American courts highlights a case where a man was diagnosed, via PET, of abnormalities in the left lateral frontal area. These abnormalities were used to support a conclusion of legal insanity at the time he assaulted people on a street with a large metal pipe. By any definition of the term, the evidence provided in these

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7 See Edward Vul et al., *Puzzlingly High Correlations in fMRI Studies of Emotion, Personality, and Social Cognition*, 4 Persp. on Psychol. Sci. 274 (2009); Nikolaus Kriegeskorte et al., *Circular Analysis in Systems Neuroscience: The Dangers of Double Dipping*, 12 Nature 535, 540 (2009).

8 Catley & Claydon *supra* note 6, at 514.

cases, and the others described in the four articles, is not rooted in science but mere speculation.

NOT REPEATING THE MISTAKES OF THE PAST

Being careful with the use of the term neuroscience is not merely a matter of semantics or usage. In my estimation it could be a matter of life or death for the future of neuroscience in the law. While that diagnosis is easy to characterize as hyperbole, an examination of the tumultuous history of forensic psychology is instructive.

It is impossible to thoroughly review the history of forensic psychology and its use in the law within the confines of this commentary. There is, however, no better example than that of Dr James Grigson. Up through 1990, Dr Grigson testified in 127 cases where prosecutors sought the death penalty. In each of these cases, Dr Grigson's testimony took the same form, as described by one person who researched his work:

> He'll take the stand, listen to a recitation of facts about the killing and the killer, and then—usually without examining the defendant, without ever setting eyes on him until the day of the trial—tell the jury that, *as a matter of medical science,* he can assure them the defendant will pose a continuing danger to society.[9]

Of the 127 cases where he provided testimony, juries provided death sentences in all but nine.[10] Forensic psychiatrists and psychologists like Grigson did not limit their commentary to diagnoses of future dangerousness. During the last half of the century, it is reported that psychiatrists and psychologists were participating in up to 1 million cases annually, providing expert scientific opinions on the issues of defendants' prior mental states, their ability to comprehend the charges against them, and whether they were legally insane at the time of their conduct, to name a few.[11]

Unfortunately for everyone, in the late 20th century it became apparent that the scientific foundation for these experts' conclusions simply did not exist. It is not that they were imperfect in making their conclusions; they were a complete fraud. To wit, a number of large studies revealed that, irrespective of education or experience, expert psychologists were no better than high school children, office secretaries, or random persons off the street at making the types of diagnoses being made under the color of science in the courts.[12] It is important to note that in these cases the science was not wrong; rather there was simply no science involved in the first place. These revelations cast a shadow of disrepute over the use of these experts in legal proceedings that maintains today.

Our experience with psychology and psychiatry in the law does not only provide a cautionary tale of what generally happens to a field when testimony is no longer bound by the science. It also useful because the majority of the purported 'neuroscience' presented in courts today is actually the same junk psychology and psychiatry of yesteryear repackaged with the allure of neuroimaging and neurojargon. But the allure is unfounded. While it can seem almost self-evident that abnormalities in a brain scan would

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9 Ron Rosenbaum, Travels With Dr. Death 210 (1991).

10 Paul C. Giannelli, *'Junk Science': The Criminal Cases*, 84 J. Crim. L. & Criminology 105, 115 (1993).

11 David Faust & Jay Ziskin, *The Expert Witness in Psychology and Psychiatry*, 241 Science 31, 31 (1988).

12 *Id.* at 32, 34.

be the cause of deviant behavior, it is critical to recognize that this is based almost purely on intuition. Two questions can make this fact clear. First, would the reader similarly rely on an expert that supported his conclusion with measurements of the size of the bumps on different parts of the subject's skull, as commonly done in the 19th century? And if not, why not? What does the neuroimaging provide that is more informative than the phrenology? Second, consider a recent conversation I had with a criminal defense attorney that made scanning of his clients' brains part of his standard operating procedure. The expert performing the scans found brain 'abnormalities' in 'every single one' of the attorney's clients (over 100 cases in total). Given the complexity of the brain, this is hardly surprising; there truly is no such thing as a normal brain. Thus we must ask whether abnormality, by itself, provides useful information for the law. In both of these points we see the same thing; intuitively we want to create a connection between the results of a brain scan and criminal behavior but, as a matter of science, there is, just as before, little to nothing to support that intuition.

CONCLUSION: PROTECTING THE POTENTIAL OF NEUROSCIENCE TO THE LAW

The importance of carefully policing the use of the term neuroscience is augmented by the potential for actual neuroscience to materially improve the just and efficient application of the law. As noted in the introduction, a huge appeal for the field of neuroscience to the law is the possibility that it can provide answers to questions long presumed out of reach. Tens of millions of dollars have been invested in developing the neuroscientific research necessary to begin providing answers with the confidence the scientific process provides. These efforts have produced meaningful results. As an example, recent work has begun to establish neural markers of subjective pain, deception, recognition, and even conscious awareness. Other work is beginning to inform how development changes the way young adults process and react to their environment. Still, more research is evaluating the brain mechanisms that support punishment decision-making in order to better understand what drives these decisions and how they can be influenced by spurious information. Each of these lines of research promises to potentially provide legal decision-makers and legislators with useful information that can improve the accuracy and effectiveness of our laws.

While most of this research is still far from providing the answers of interest to the law, it is moving in that direction. Two recent cases demonstrate what using good neuroscience in the courts might look like. In *Miller v Alabama*, the US Supreme Court referenced a large body of peer-reviewed neuroscience on adolescent development in support of its holding that mandatory sentences of life without the possibility of parole are unconstitutional for juvenile offenders.[13] In *U.S. v Semrau*, a federal appeals court reviewed the scientific merit of testimony based on fMRI lie detection and found that it did not meet the standards of the Federal Rules of Evidence. However, in making this determination the court laid a clear framework for its possible future admission as evidence.[14] And, perhaps most importantly, researchers have started to scientifically

[13] 132 S. Ct. 2455 (2012).
[14] 693 F.3d 510 (2012).

address some of the shortcomings raised by the court. While both examples are incremental, they can be lauded for their fidelity to the science.

In 1988, David Faust and Jay Ziskin wrote of the unfortunate irony behind the revelation that the forensic psychology being used in the courts was without scientific merit. Though written three decades ago, the rapid advancement of neuroscience makes their words truer now than ever. They wrote: 'research should eventually yield more certain knowledge and methods that provide meaningful assistance to the trier of fact' but that 'the courts, having learned to distrust clinicians' claims, may refuse to admit testimony based on truly useful knowledge and methods despite more than adequate supportive studies.'[15] Thirty years later, psychology's reputation in the law still has not recovered despite marked improvements in the field. The only question now is whether in 30 years' time neuroscience will have the same fate. By being casual with the use of the term neuroscience we are asking for just that.

[15] Faust *supra* note 11, at 35.