Journal of Law and the Biosciences, 330–335
doi:10.1093/jlb/lsw028
Advance Access Publication 14 June 2016
Peer Commentary

The use of neuroscience evidence in criminal proceedings

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INTRODUCTION

While law and neuroscience has been an increasingly popular topic in academic discourse, until now, little systematic research had examined how neuroscience evidence has actually been used in court. Do courts actually admit and consider evidence of brain trauma that might indicate that an individual did not have the capacity to achieve the mental state required for conviction of particular crime? Do they use such evidence to consider the relative culpability for the crime in the event of conviction? Do they consider or understand brain scan data? For much of the life of this infant field, we have only been able to guess as to the answers to these questions.

The four papers discussed here begin to fill that gap in the literature. Each provides a critically important window into use of neuroscience evidence in a large sample of criminal cases of a particular jurisdiction. Importantly, this work provides a guidepost for neuroscientists and legal scholars as to what types of neuroscience evidence courts find relevant and useful—critically important information that should allow scholars to target their work if they hope for it to have practical effects in the courts. Essentially, this type of research provides the critical link between *producers* of the law and neuroscience product (i.e., researchers producing scholarship) and the most important *consumers* of that product (i.e., courts applying that research to more fairly resolve cases).

In this peer commentary, I briefly provide a summary of what I think are the most important aspects shared between four papers, and discuss critical differences between them. I also provide some suggestions for follow-up work, building on the framework laid out by these authors, and make some predictions as to how neuroscience evidence might be used in the future.

DISCUSSION

Each of the four papers discussed here seeks to answer the same question: how are courts currently using neuroscience evidence in criminal cases? Each of the papers approaches this question using a similar method: collection of judicial opinions using a commercially available database and coding of those opinions for the nature of the evidence and the context in which it was introduced. And each of the papers reports, for the most part, similar data. Neuroscience evidence is being used more frequently, is having a greater impact on cases, and is being considered in more depth by courts. I briefly discuss some interesting aspects of the authors' methods and the data they report below.

Methods

While each of the papers employed a case-coding method to identify cases in which neuroscience evidence was introduced, there is some variation between the papers in the nuance of that method that may raise questions as to how easily the resulting data can be compared. I focus on two areas of some difference between the papers: (i) the coding and checking of reliability and (ii) the types of cases examined.

Reliable coding of qualitative information, such as the legal opinions observed here, is one of the most difficult tasks in social science. While each study here employed a predetermined set of coding criteria that was developed through pilot reading of cases, each paper took a slightly different strategy in evaluating the opinions themselves. The coding teams ranged from very large (20 coders in the Farahany study)[1] to relatively small (two coders in the Kogel & Westgeest study and, it appears, only the author coding in the Chandler and Catley & Claydon studies),[2] though the multiple-coder studies used two coders per case. Most pertinent for this discussion is the fact the single-coder studies cannot provide any measure of inter-rater reliability, and multiple-coder studies provide somewhat moderate explanations of reliability checks.[3] When using such methods, there is always some concern for implicit experimenter bias, and more rigorous inter-rater reliability checks are typically the measure used to allay such concerns.[4] Understandably, the sheer size of the data sets here, including thousands of dense legal opinions, made such checks prohibitively difficult, but the inevitable follow-up research to these studies would do well to expand on these methods. For the purposes of these studies, two facts provide some comfort that the coding procedures were sufficient. First, for the most part, the four papers found remarkably similar results, both in the amount of neuroscience evidence offered and the ways in which this evidence was used, and serve as a sort of reliability check between each other. Second, the

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1 Nita A. Farahany, *Neuroscience and Behavioral Genetics in U.S. Criminal Law: an Empirical Analysis*, 1 J. L. & Biosci. 1, 5 (2015).

2 See C.H. de Kogel & E.J.M.C. Westgeest, *Neuroscientific and Behavioral Genetic Information in Criminal Cases in the Netherlands*, 1 J. L. & Biosci. 1, 4 (2015); Jennifer A. Chandler, *The Use of Neuroscientific Evidence in Canadian Criminal Proceedings*, 1 J. L. & Biosci. 1 (2015); Paul Catley & Lisa Claydon, *The Use of Neuroscientific Evidence in the Courtroom by Those Accused of Criminal Offenses in England and Wales*, 1 J. L. & Biosci. 1 (2015).

3 See Farahany, *supra* note 1, at 6 (describing 'less than 5 per cent disagreement between coders' but not explaining how disagreement was measured); Kogel & Westgeest, *supra* note 2, at 4 (noting that '[w]hen scores [between coders] differed from each other, these were discussed and consensus was sought'.).

4 See e.g., Charles P. Smith, *Content Analysis and Narrative Analysis*, in Handbook of Research Methods in Social and Personality Psychology 313, 335 (Harry T. Reis & Charles M. Judd eds., 2000).

information coded here was, with a few exceptions, relatively straightforward and objective (such as the type of neuroscience evidence used and the case context in which it was used), and one would not expect much inter-coder difference in the data set.

One other methodological difference between the papers warrants mention: three of the studies code cases from both trial-level courts and appellate courts.[5] The Catley and Claydon study, however, primarily codes only appeals, as most decisions of first instance are not included in English and Welsh reporters.[6] This is significant, as trial courts tend to be the primary bodies where novel issues of evidence are decided, and cases in which neuroscience evidence is introduced may be missed by only considering appellate cases because decisions related to the neuroscience evidence may never be raised on appeal. This important distinction is worth keeping in mind when considering differences in the results of the papers, though it is likely at least partially alleviated by the fact that neuroscience evidence is unusual and novel, making any introduction or denial of neuroscience evidence a likely target for appeal. This distinction also raises a potentially important question for further study that is not answered in these papers: is there any difference in how neuroscience evidence is raised in appellate courts as compared with trial courts? Is the reception for such evidence by the court different at different levels? None of the three papers that codes both types of cases makes a detailed distinction between them;[7] such questions may be useful to address in future work.

Amount of neuroscience evidence

The most basic data reported in the studies are the raw amounts of neuroscience evidence that is introduced in courts, at least as captured through the search measures and coding methodologies of the four studies. These raw counts are remarkably similar across the jurisdictions. Notably, the rate at which introduction of neuroscience evidence is *increasing over time* is remarkably similar between the studies. Though the studies do not all examine the same range of time,[8] each study shows a sharp increase in the use of neuroscience evidence until around 2009 or 2010, at which point the upward trend begins to level off (the Kogel study is an relative outlier in this regard, with a continued increase in the use of neuroscience data through 2012). Though the sample sizes here are small (only 30–50 cases per year in three of the four jurisdictions), the fact that the slope of the curve is relatively consistent across jurisdictions is striking. Do these data indicate a waning in the popularity of neuroscience evidence following its initial explosion? In such a new field, only time will tell, though I expect the trend line will continue upward, as discussed below.

Likewise, the total number of cases themselves is strikingly similar across jurisdictions, with the notable exception of the United States. The three non-US studies

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5 See Farahany, *supra* note 1, at 6; Chandler, *supra* note 2, at 3; Kogel & Westgeest, *supra* note 2, at 5. All three of these studies also appear to code cases from both the federal/national level courts and the state/provincial level courts. See *id.*

6 See Catley & Claydon, *supra* note 2, at 2 n.1, 6.

7 The Chandler study notes that, of the 133 cases coded that involve neurobiological evidence, 112 come from trial-level courts and only 21 come from appellate courts. Chandler, *supra* note 2, at 10.

8 The Farahany and Catley & Claydon studies sample cases from 2005–2012, while the Kogel & Westgeest study samples 2000–2012 and the Chandler study 2008–2012. Farahany, *supra* note 1, at 8; Catley & Claydon, *supra* note 2, at 9; Kogel & Westgeest, *supra* note 2, at 5; Chandler, *supra* note 2, at 8.

report case numbers of around 15 per year between 2005 and 2008, increasing to around 35–50 in 2012.[9] The US numbers are much larger, and while this is likely at least partly an effect of an increased total number of reported cases in the United States as compared to the other three jurisdictions, that likely does not fully explain the near ten-times difference between jurisdictions.[10]

Context of evidence used

Perhaps the most useful data reported in these studies relates to the context in which neuroscience evidence is introduced. Unsurprisingly, the most common use of neuroscience evidence appears to be in the sentencing context, where neuroscience evidence is typically introduced in order to mitigate the culpability of the defendant.[11] This context provides an ideal environment, where admissibility considerations are reduced and evidence of a defendant's current physical or mental state is relevant (unlike some liability questions, where the only relevant mental state is the one that existed at the time of the crime and cannot be measured during litigation).

Another notable finding is that neuroscience evidence tends to be used more frequently in high-stakes cases, such as homicides or sexual assaults.[12] Is this effect because neuroscience evidence is somehow particularly relevant in these cases, or is it instead because parties in more important cases tend to devote more resources to those cases, including employment of neuroscience experts? If the latter is the correct explanation, it would indicate that, as the cost of producing neuroscience evidence decreases, we will see an increase in its use.[13]

Last, I briefly flag one promising context for neuroscience evidence: findings of competency to stand trial or to make decisions in various aspects of the litigation. The only study to find extensive use of neuroscience evidence in this context is the Farahany study, which found that 15 per cent of all uses of neuroscience evidence were related to competency.[14] Though full analysis of this finding is beyond the scope of this short commentary, neuroscience evidence could be particularly useful in this context, which often involves battles of competing experts and difficult decisions for judges to make based on questioning of criminal defendants at voir dire.

Potential follow-up work

These exciting studies tee up a number of questions for follow-up work. I briefly describe three areas that might be particularly interesting and important for the progression of neuroscience's impact on the law.

First, for the most part, these studies answer the narrow question of when and how often neuroscience evidence is *introduced* into criminal courts. But now that it is clear that neuroscience evidence is important to the courts—and becoming more

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9 See *id.*

10 See Farahany, *supra* note 1, at 8 (reporting over 300 neuroscience cases per year during peak years).

11 E.g., Catley & Claydon, *supra* note 2, at 10; Farahany, *supra* note 1, at 12; Chandler, *supra* note 2, at 15.

12 Farahany, *supra* note 1, at 9; Chandler, *supra* note 2, at 12; Catley & Claydon, *supra* note 2, at 9.

13 An alternative explanation, however, could be that individuals who commit serious crimes are more likely to have neurological problems that can be raised during litigation, and the cost of producing neurobiological evidence is not a factor in its use.

14 Farahany, *supra* note 1, at 12, 13. Contrast this with the Kogel study, which found just four cases using neurobiological evidence in the competency context. Kogel & Westgeest, *supra* note 2, at 8.

important—a critical question becomes: how is this evidence treated in court *once it is there* by judges and other legal decision makers? Do they know how to consider it properly? Do they spend time analyzing it? Do they merely defer to experts in assessing its admissibility or weight? Even beginning to answer these questions, of course, is an extremely difficult task, as they involve much more subjective decisions than the ones made by coders in these studies, and likely vary substantially be context. The Farahany study provides an interesting data point in reporting that, in recent years, judicial opinions have provided much more substantive discussion of neuroscience evidence than they did in prior years. Such comparatively straightforward coding, perhaps measuring the type of discussion devoted to neuroscience evidence (e.g., criticism of expert methods, relevancy of the evidence, or weight), might be a logical first step in answering these more complex questions.

A second difficult, but important, avenue for follow-up work involves questions about the *value* of neuroscience evidence, both in terms of broad litigation outcomes and evidence-specific outcomes. When neuroscience evidence is offered, is it often taken seriously? What are the arguments made by the attorneys both for and against its inclusion? Which arguments do judges tend to accept? And when neuroscience evidence is introduced into evidence, is it important in shaping outcomes? In which direction? Among the papers in this issue, the Catley and Claydon study does the most to take on these types of questions, providing data regarding success rates, and notably finding that where neuroscience evidence is discussed in appeals of criminal convictions and the defendant is successful, the neuroscience evidence introduced is largely important to that success.[15] The anecdotal discussions at the end of each of these papers further provide indication of how neuroscience evidence is responded to and how it shapes cases,[16] but more detailed study would shed significant light on the strengths and weaknesses of neuroscience evidence as it is currently used in court, from a legal perspective.

Last, similar research in the civil arena would be extremely illuminating. Neuroscience's application to the law is often discussed in the criminal context, but, as others have noted, the potential civil applications of neuroscience evidence are many, particularly in terms of measuring pain, memory or other cognitive deficits, or other brain injuries that might be alleged in a tort claim.[17] A better understanding of how similar evidence is used in those contexts would help researchers understand potential applications for their work.

Projections for the future

Last, I offer just a couple of thoughts as to how the use of neuroscience evidence may change in the future. First, I expect that neuroscience evidence will continue to be used more frequently in courts over time. As a field, neuroscience is still in its infancy

[15] Catley & Chandler, *supra* note 2, at 12, 13. That conclusion is, of course, tempered by the difficulty of defining 'success' and measuring which factors were most important in achieving success. See *id.* at 10, 11.

[16] E.g., Farahany, *supra* note 1, at 15 ('Because the present neurobiological evidence may have little bearing on the defendant's actual competency to have confessed at the time of the crime, courts may give neurobiology little weight particularly in comparison to other circumstantial evidence that bears on the defendant's likely capacities at the time.').

[17] For a general overview, see Owen D. Jones, Jeffrey D. Schall & Francis X. Shen, Law and Neuroscience 303–420 (Wolters Kluwer Law & Business 2014).

compared to many other sciences, and there's a strong likelihood that significant fundamental breakthroughs in our understanding of human brain activity and its resulting behavior are still to come. While it appears from the data reported in these papers that the growth of the use of neuroscience evidence is slowing, I expect to see short periods of rapid growth as breakthroughs are made and as influential courts begin to consider neuroscience evidence, followed by other periods of less substantial growth.[18] Of course, many issues must be overcome for neuroscience evidence to be broadly applicable to the law—most notably, the problem of extrapolating the group data typically available in neuroscience research to the individual claims at issue in a single case—and so the change will not be overnight.[19]

Second, one of the notable results of several of these studies is that while the use of neuroscience evidence is on the rise, the use of imaging in that evidence is still relatively uncommon.[20] I expect that this will change in the future. As has been discussed extensively elsewhere, the use of fMRI in psychological and neuroscience research has rapidly increased over the past few decades, in part due to decreasing costs of access to imaging equipment. As these costs continue to decrease and access to imaging equipment increases, I expect that both the amount of imaging-based research and the number of individual criminal defendants who can access imaging to use for their defense will increase, and, in the long run, I expect that imaging will be common evidence in the courtroom.

CONCLUSION

This is a wonderful time for those interested in law and neuroscience because the field is so new, and significant basic work remains to be done. This set of papers provides one such critical early impact. The papers provide strong evidence that neuroscience has an important future in the law, and while there are undoubtedly limited uses of neuroscience evidence as the science currently stands, those limitations are likely to become smaller as technology and knowledge improve.[21] Research on the courts' use of neuroscience evidence, like these studies, will thus continue to be important as the field grows.

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[18] For example, cases like the oft-cited Graham v. Florida, 560 U.S. 48 (2010)—which cited neurobiological evidence in holding that life-without-parole sentences for juvenile offenders are cruel and unusual in violation of the Eighth Amendment for non-homicide offenses—may encourage attorneys to attempt to use neurobiological evidence more frequently. The effects of that notable case may only be starting to be felt in the datasets reported here, and it is likely that future cases will further push the ball forward.

[19] See generally David L. Faigman, John Monahan & Christopher Slobogin, *Group to Individual (G2i) Inference in Scientific Expert Testimony*, 81 U. Chi. L. Rev. 417 (2014).

[20] E.g., Farahany, *supra* note 1, at 10; Chandler, *supra* note 2, at 9.

[21] One important point to consider here is that all flawed technical evidence must always be considered not to the extent that it is perfect, but rather through the lens of whether it is better than the alternative. See e.g., Farahany, *supra* note 1, at 24; John B. Meixner Jr., *Liar Liar, Jury's the Trier? The Future of Neuroscience-Based Credibility Assessment and the Court*, 106 Nw. U.L. Rev. 1451, 1487–88 (2013).