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Neuroimages in court: less biasing than feared

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Neuroscience is increasingly poised to play a role in legal proceedings. One persistent concern, however, is the intuition that brain images may bias, mislead, or confuse jurors. Initially, empirical research seemed to support this intuition. New findings contradict those expectations, prompting a rethinking of the 'threat' of neuroscience in the courtroom.

Because neuroimages have the potential to seem more 'real' than other kinds of evidence and are a product of neuroscience – a field typically considered a 'hard' science – brain images might have unusual impact as legal evidence. Brain images resemble photographs and laypersons might view them as simple and direct pictures of brain activity. Of course, brain imaging is not photography and is neither direct nor inferentially straightforward. The layperson is unaware of the many steps involved in producing a neuroimage and relating it to a particular cognitive process or capacity. The greater the 'inferential distance', the more opportunity for error and unfounded beliefs that could lead to unwarranted conclusions [1].

Several studies tend to support the hypothesis that neuroscience information affects people's reasoning adversely. Weisberg *et al.* [2] found that participants were able to distinguish good from bad scientific explanations when no neuroscientific information was included. However, when neuroscientific information was added, poor logic appeared sound. The authors interpreted their findings to suggest that laypeople are 'dazzled by neurobabble'. Although that study did not explicitly test the effect of neuroimages, another did. McCabe and Castel [3] examined whether brain images affect people's judgments of scientific credibility. They found that, when neuroimages accompanied scientific summaries, the summaries were rated as more scientifically credible and sound than the summaries presented alone or paired with graphs.

These studies did not examine people's reasoning in legal contexts. However, a few studies do. Gurley and Marcus [4] found that mock jurors were more likely to reach a verdict of not guilty by reason of insanity (NGRI) if psychiatric diagnoses were supplemented with anatomical brain images and McCabe *et al.* [5] report a mock-trial experiment where functional MRI used for lie detection was significantly more persuasive than other technologies (e.g., polygraphs or thermal imaging lie-detection).

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All these studies are consistent with the possibility that brain images are biasing or misleading, and many legal commentators have taken them as such [6–8]. However, none of these studies isolate the effect of neuroimages *per se* while also setting the study in the context of a trial.

A different picture emerges from a series of new studies targeting the effects of neuroimages in the courtroom. Schweitzer *et al.* [9] designed four experiments to isolate the effects of neuroimage evidence: laypersons were presented with mock trials containing various kinds of expert testimony. After being presented with the case, evidence, and legal instructions, participants were asked to evaluate the evidence and render a verdict and other judgments.

By using various control conditions, these experiments assessed the impact of neuroimages on juror decisions separately from the effects of other information in the trial. Various groups were presented with verbal expert testimony of psychologists, neuropsychologists, or neuroscientists, as well as a no-expert control. The neuroscience testimony was paired with brain images, graphs, or a neutral image (a courtroom). Expert testimony reflected what is typical in such cases. Among other measures, jurors provided judgments of criminal liability and punishment recommendations.

Neuroscientific evidence was introduced by the defense as exculpatory, supporting the claim that the defendant lacked necessary elements of criminal culpability. However, in experiments with crimes ranging from homicide to unintentional assault, the authors found no evidence that neuroimages influenced jurors' decisions about criminal liability or sentences. Convictions and punishments were, however, related to the level of perceived control by the defendant, and this was affected by the presence and kind of expert testimony – but not by neuroimages.

A subsequent experiment by Schweitzer and Saks [10] examined the potential impact of brain images in insanity cases. Given the results from Gurley and Marcus [4], one might expect neuroimages to affect NGRI verdicts. However, Gurley and Marcus did not dissociate the effects of the neuroimage from those of the neurological expert testimony. Schweitzer and Saks did, and found no impact of neuroimages over and above the effects of verbal neuroscience testimony, while replicating the earlier findings that neuroscientific testimony was more effective in securing NGRI verdicts than psychological testimony. (Interestingly, mock jurors presented with no expert evidence rated neuroimages as the kind of evidence that they would have found most helpful.)

In summary, these recent studies asking whether neuroimages are biasing in trials where criminal liability is at issue found no inordinate effects – or any impact at all beyond that of conventional neuroscience expert testimony. This lack of impact has been more broadly confirmed by Farah and Hook [11], Gruber and Dickerson [12], and Schweitzer *et al.* (unpublished), who have failed to replicate earlier findings that first hinted at the persuasive power of neuroimagery.

The neuroimages used in the Schweitzer *et al.* experiments [9] contained no information beyond that contained in the expert testimony, thus allowing assessment of whether images produced effects over and above the admissible verbal testimony. That is, the research asked whether images *qua* images affect jurors unduly. Contrary to expectation, no evidence emerged that neuroimages are biasing or misleading in forensic contexts. Indeed, the findings suggest that brain images have no special impact on juror decision-making beyond the neuroscientific testimony.

The studies described above were limited in scope, focusing on issues of exculpation in criminal cases. However, the issue of mitigation of punishment of convicted defendants is where neuroimages might have their greatest impact. Indeed, that is what was found in two studies of the penalty phase of capital cases ([13], Saks *et al.*, unpublished), where neuroimages reduced the execution rate of psychopathic defendants.

These studies have an immediate practical implication. If neuroimages cannot be excluded as evidence and if neuroscience evidence is found to be mitigating in sentencing, neuroimages might come to be routinely offered as evidence in capital cases. Then, it will be increasingly important that judges and jurors be sufficiently educated to understand the ways in which neuroimaging evidence can be relevant to legal questions and to recognize when they are not. Devising effective ways of educating legal actors will be essential. Second, given the apparent impact of neuroscience testimony relative to non-neuroscientific testimony and the current costs of neuroimaging, as well as the importance of cross-examination to putting neuroscience in perspective, such evidence could exacerbate the effects of economic inequalities among defendants.

Moreover, some believe that neuroimaging will play a major role in civil law in the future, such as in tort and worker compensation cases. Research on the effects of imaging evidence in civil cases – where the threshold of proof for deciding liability is in closer balance – is needed.

The question of how probative neuroscience evidence is for the law remains an open one and the answer will depend on the precise techniques used and legal circumstances. Clearly, there are some cases where neuroevidence contributes significant probative value (e.g., anatomical neuroimaging as evidence of injury) and the range of contexts where neuroimaging is probative will likely increase as the technology and our understanding of anatomical-functional mapping evolves.

Despite the limited effect of neuroimages, the Schweitzer *et al.* [9] and Schweitzer and Saks [10] studies (as well as Saks *et al.*, unpublished) have identified consistent effects of neuroscience testimony on legal decision-making and a more robust effect than that of psychiatric and psychological testimony. These results are broadly in line with the results of Weisberg *et al.* [2] and are likely due to the lay intuition that neuroscience is a 'harder' science than the behavioral sciences. However, behavior-relevant psychology and imaging neuroscience rely on similar conceptual methods and ultimately on the classification of observed behaviors. If one is skeptical of the diagnosis of schizophrenia on the basis of clinical observation, there is no reason to be any less skeptical about neurological evidence for schizophrenia, because the neuroscientific relevance is predicated on the psychiatric diagnosis. This common foundation is likely not grasped by the layperson and this confusion highlights the importance of educating participants in the legal system regarding the interpretation of neuroscientific evidence. On the other hand, neuroscientific understanding and psychological frameworks are interdependent: as neuroscientific knowledge deepens, it has the potential to refine the way we view mental disorders, so that the greater weight it receives might come to be deserved.

For many, neuroscience offers the prospect of allowing us to categorize brain dysfunction in a more fine-grained fashion and potentially to revise current ways of viewing mental dysfunction, perhaps making the law more just. To do this, neuroscience will have to engage more directly with questions of how neuroevidence is relevant to legal criteria for culpability and perhaps ultimately to reshape those criteria. Others question whether the law should be responsive to neuroscientific details (see, e.g., [14,15]). They argue that the law is indifferent to micro-causal analyses of the genesis of behaviors and concerned only with what people do, the nature of their mental states, and the existence of excusing conditions. The appropriate role of neuroscience in law remains a matter of debate. Perplexing philosophical and practical issues beset research concerning the applicability of neuroscience to the law.

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