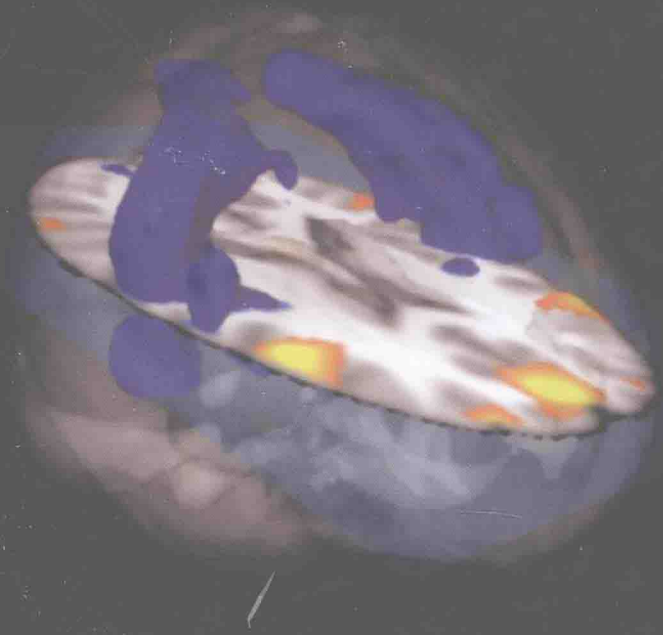
Neuroimaging in Forensic Psychiatry

FROM THE CLINIC TO THE COURTROOM



Edited by
Joseph R. Simpson, M.D., Ph.D.
Foreword by Henry Greely, J.D.

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From the Clinic to the Courtroom

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Cover image shows brain fMRI differences between lie and truth in a group of 22 healthy subjects. Lie related activation is in yellow and truth related activation is in blue. Reproduced courtesy of Kosha Ruparel, M.S and Daniel Langleben, MD, University of Pennsylvania, Philadelphia, PA, USA.

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Foreword

This is an interesting and important book, both for the professional audience that is likely to read it and, perhaps more importantly, for another audience that needs to read it. It is an education in how neuroscience may affect the law, as well as a stark warning about the limits of our current discourse in law and neuroscience.

I have been involved in neuroethics and, more specifically, in law and neuroscience, since its inception – or, at least, its 're-imagining' – in 2002. I was one of the co-directors for the Law and Neuroscience Project, a three-year effort funded generously by the MacArthur Foundation that brought lawyers and judges together with neuroscientists and psychologists, with the more-than-occasional philosopher thrown in for extra flavor. This book has 34 authors; only one was involved in the Project. In fact I only recognize the names of three of the authors from the discussions of law and neuroscience. (Nor do I recognize many of the names for their activity in the International Neuroethics Society, another high-profile effort that looks at, among other things, law and neuroscience.) This is *not* a negative reflection on the quality of these authors, but it is a negative reflection on the nature of our discourse about law and neuroscience. This book is entitled *Neuroimaging in Forensic Psychiatry: From the Clinic to the Courtroom*. Its authors are, by and large, forensic psychiatrists or researchers with connections to forensic psychiatry. The Law and Neuroscience Project comprised mainly lawyers, philosophers and neuroscientists. It, and the broader discussions it was part of about law and neuroscience, focused not on the path from the clinic, but from the *lab* to the courtroom (as well as parts of the legal system that exist outside the courtroom).

The intersections of these worlds have been far too few, and too narrow. As this book convinces me, the broad field of law and neuroscience has much to learn from the forensic psychiatrists, who, after all, are regularly involved in applying brain science in courts. And, I believe, forensic psychiatrists could learn useful things, too, from the broader law and neuroscience community.

The first part of the book provides an introduction to neuroimaging technologies that is comprehensive, but that is also accessible to lawyers and judges – at least, to those who are willing to work just a bit at it. The technologies might have been expanded, both to old standbys, such as CT scans and electroencephalograms (EEGs), as well as to upcoming possibilities, like near infra-red laser spectroscopy. But it covers the main bases – PET, SPECT, MRI and fMRI – quite well.

The second part will also prove particularly useful. It provides readers with useful discussions of some of the most legally relevant diagnoses – traumatic brain injury, dementia, psychopathy, pedophilia, psychosis and affective disorders – as well as strong, critical reviews of the current, and possible future, roles of neuroimaging in confirming (or ruling out) those diagnoses. Forensic psychiatrists may want to focus on the discussions of neuroimaging, but many readers from the law will learn much from the careful discussions of the illnesses themselves.

Part III brings us directly to the courtroom and walks through the possible roles of neuroimaging in the most common reasons for testimony by forensic psychiatrists: competency, insanity, mitigation, diminished capacity, risk assessment and personal injury cases. The most valuable sections lay out just how neuroimaging may, or may not, be useful in such cases.

The fourth part looks at some frontier legal issues for neuroimaging. One chapter takes a hard look at detecting deception; the other at detecting memory. These highlight the reality that one exciting possible use for neuroimaging is to read minds – to look at physical brain states and correlate them to present mental states. This cannot reveal what, for example, a defendant was thinking at the time of the alleged offense; the so-called 'time machine' problem prevents that. But it may be able to tell us something about their mental states at the time of their subsequent statements. Normally, if we want to ascertain someone's mental state, the best way to do so is to ask them. But if we cannot trust them to answer honestly, reading their minds may be a good alternative. I only wish this part had roamed a little more broadly across the landscape of possible uses of mind-reading in the law, from detecting whether someone is feeling pain (an enormous issue for the legal system) to determining whether someone is 'truly' feeling bias or remorse or guilt.

The last part looks at legal issues in the United States and in England and Wales, and at ethical issues more broadly. This is territory that has been broadly explored in the existing law and neuroscience literature (see, for example, [1–6]); these chapters are clear discussions, and quite useful for forensic psychiatrists, though lawyers, judges and philosophers may prefer more specialized treatments.

Forensic psychiatry and the broader law and neuroscience community need to talk more. The depth and breadth of forensic psychiatry's knowledge of the technologies, the diseases and the courtroom settings will be of great value to the broader law and neuroscience community. On the other hand, forensic psychiatrists should find value in the deeper discussion of the thorny legal questions – and of the ethical and philosophical questions that lie behind them – that the broader law and neuroscience literature provides, along with the, admittedly speculative, look farther beyond today's courtroom uses, to future uses – and to the ways technological change and social change may intertwine to produce surprising results. It is unfortunate, and somewhat surprising, that these perspectives have not yet been better integrated. One can say the field is young or, at least, newly reconceptualized, but the current neuroethics field is approaching the end of its first decade. We should not let this distance continue into its second.

Which leads to my last point. Bringing all the relevant expertise and perspectives together into this field is not just 'good' but important, because the field is important. Neuroscience is vastly increasing our ability to predict, understand and modify the workings of the human brain. The law is about human brains, and only incidentally about the flesh in which they are embodied. Knowing more about future behaviors, or about present mental states or about how to change mental states or behaviors will necessarily be of great interest to the law (and to the rest of society). But knowing more about the science of the human brain is not the same as knowing enough about how to use that new knowledge. Wayne Drevets, Jonathan Savitz and Joseph Simpson end their chapter on affective disorders with some carefully hedged prophecy, with comments specifically about affective disorders but applicable much more broadly to law and neuroscience:

> *Looking forward, it seems reasonable to anticipate that as the evidence base continues to accumulate, neuroimaging may be used increasingly in legal cases to buttress*

a diagnosis of mood disorder. It is conceivable that in the future the development of valid and reliable diagnostic neuroimaging biomarkers will serve to diminish the common perception among the general public, and even among many attorneys and judges, that mood disorders (among other common psychiatric diagnoses such as PTSD and other anxiety disorders, etc.) are purely 'psychological' conditions, devoid of a detectable physical basis. Ultimately, the availability of such clinical diagnostics may lead to significant changes both in the nosology of psychiatric disorders and in the definitions applied in legal areas such as disability, workers' compensation, tort liability and others. However, it is also undoubtedly true that, just as with any other proposed scientific evidence, attempts to use imaging data to draw conclusions that are more broad than the results can actually support will not pass muster in the courts.

Neuroimaging not only may be used in courts, it is already being used and its possible applications are increasing. It not only *may* change public perceptions about mental conditions, it already is. It has not yet led to changes in the definitions of diseases (and of 'normal' variations) used in medicine and law, but it will. But our biggest fear should not be that efforts to introduce into courtrooms unjustified conclusions from neuroscience will not pass muster, but that they *will* pass muster – or not be put to the test at all. The potential downside is not that litigants overreach, unsuccessfully, wasting the system's time and money, but that they overreach *successfully*, putting lives, justice, liberty and truth at risk. I cannot now answer the question of which technologies will prove appropriate for which uses – no one can, yet. But I am certain that we, as a society, along with other societies around the world, will be forced to answer that question. To do so well we will need all the mental resources – all the *brains* – we can muster. All of us worrying about these questions must work together if we are to have a chance even to muddle through, avoiding catastrophic mistakes.

Joseph Simpson, this book's editor, states in the book's introduction that 'The intended audience is practicing forensic psychiatrists and psychologists,' but then goes on to predict that 'psychiatrists and psychologists who are not currently involved in forensic work, as well as neurologists, radiologists, attorneys and judges will be able to use this book.' Niels Bohr, the Danish nuclear physicist, is often credited with having said 'It's always hard to predict things, especially the future.' Actually, it is easy to make predictions; it is just hard to be right about them. I hope Simpson's prediction is right – it certainly deserves to be.

Henry T. Greely
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Introduction

The past several decades have witnessed a tremendous expansion in the technological ability to visualize the structure and functioning of the living human brain. Imaging methods such as magnetic resonance imaging (MRI), positron emission tomography (PET) and single-photon emission computed tomography (SPECT) are now routinely used in the evaluation of neurological diseases and conditions such as cancer, multiple sclerosis, stroke and traumatic brain injury. The years ahead promise further improvements in these and other imaging techniques.

Tools in the researcher or clinician's armamentarium for examining the structure and function of the human brain *in vivo* are often referred to as *neuroimaging modalities*. For consistency and simplicity, this term is used throughout this book to describe techniques which are used to produce images of the structure, activity or distribution of biological molecules within the living brain. In the field of psychiatry, the primary clinical application of neuroimaging at present is to rule out neurological or 'organic' causes of psychiatric symptoms. While there is a large and constantly expanding body of research applying neuroimaging techniques to mental disorders, neuroimaging has not yet entered the mainstream of routine clinical practice in psychiatry.

This is likely to change in the near future. Many researchers predict that neuroimaging will soon be used to more accurately diagnose psychiatric conditions, as well as to predict and monitor patients' responses to medications or other treatments. As accuracy, reproducibility and standardization increase, and as the cost of performing the tests falls, neuroimaging techniques will be added to the toolbox of clinicians treating patients. It is unlikely that psychiatric neuroimaging will remain the sole province of research scientists for much longer.

As neuroimaging enters clinical practice, so too will it find its way more and more into legal proceedings. The legal arena has seen imaging results offered as evidence for a psychiatric diagnosis as far back as three decades ago, when a computerized tomography (CT) scan was introduced to support a diagnosis of schizophrenia at the insanity trial of John Hinckley, who shot President Ronald Reagan and three others in 1981. This foreshadowed the burgeoning use of all manner of imaging data in court. In the 1990s and 2000s, data from MRI, PET and SPECT scans have been introduced in hundreds, if not thousands, of civil and criminal proceedings in the United States and many other countries. In some cases, the proffered evidence was ruled inadmissible, but in many other cases judges have allowed imaging data to be presented at trial. Of course, the impact of such evidence on the final decision by the trier-of-fact (i.e., judge or jury) is a critical question – the fact that evidence is allowed to be heard does not necessarily mean that it will be persuasive, or even that it will be considered at all.

The field of forensic psychiatry is approaching a crossroads. As neuroimaging becomes ever more reliable, standardized and informative, attempts to use its results in civil and

criminal proceedings of all types will increase dramatically. Accurate diagnostic tests for mood disorders and anxiety disorders such as post-traumatic stress disorder (PTSD) could potentially revolutionize the field of mental health disability litigation. In criminal justice, some observers anticipate profound changes in how the legal system assesses and manages criminal defendants with psychiatric conditions, or even criminal offenders in general. Others disagree, and predict that the role of neuroimaging in the criminal justice system will remain peripheral.

The unprecedented ability of sophisticated techniques such as functional MRI (fMRI) to create images of an individual's neural responses to a single stimulus event has created the possibility of entirely novel applications, such as the detection of deception and the identification of memories. Already the use of fMRI for lie detection has moved out of the realm of science fiction, but the technique has by no means become widely accepted. Some question whether it will ever be specific and reliable enough for any applications outside of cognitive neuroscience research.

In an intriguing 2008 study, researchers were able to categorize whether their subjects were thinking about tools or about dwellings by analyzing their fMRI data [1]. This finding suggests the possibility of a primitive form of 'mind reading,' and garnered attention in the popular media [2]. Clearly, the potential implications of such a capability are profound.

The idea of using neuroimaging for legal purposes has its share of skeptics. The statistical nature of functional neuroimaging studies and the wide variability among individual brains have been suggested as fatal flaws for those who hope to introduce what amount to probabilities into a context that demands categorical answers. More fundamentally, a number of authors have questioned whether neuroimaging results can be meaningfully applied to essential legal questions such as intent, state of mind and causation. Some have directly accused the advocates of so-called 'neurolaw' of intending to use neuroimaging as a lever to completely redefine the criminal justice system, such that free will and personal responsibility disappear, replaced by deterministic chains of causation beyond the control of the individual criminal defendant [3, 4].

Even if the technological and methodological obstacles to using neuroimaging in the courtroom can be overcome, a number of legal and ethical questions arise. To cite only a few from the criminal context, how would performing a neuroimaging study on a criminal defendant impact that person's rights, such as the right to be free of unreasonable search and seizure, or the right against self-incrimination? The potential risks of rushing to adopt new technologies before they have sufficiently matured have also been pointed out [5].

The purpose of this book is to provide a frame of reference in which to consider the current and potential future applications of neuroimaging in forensic mental health. It will examine in detail the limitations of using neuroimaging in court, as well as the unanswered questions that arise as the field of neuroimaging evolves, and attorneys and mental health professionals seek to apply its findings in legal proceedings. The intended audience is practicing forensic psychiatrists and psychologists. Forensic practitioners are increasingly being asked to respond to or interpret neuroimaging findings as they are applied to core medicolegal questions such as competence, criminal responsibility, personal injury, disability, and so on. The book is designed as a resource to help forensic practitioners understand and navigate this new area, and to gain an appreciation of topics of disagreement and controversy within it.

In addition, psychiatrists and psychologists who are not currently involved in forensic work, as well as neurologists, radiologists, attorneys and judges will be able to use this book to further their knowledge of the growing subject of neuroimaging in forensic

psychiatry. The overarching objective is to give the reader a practical, realistic idea of what neuroimaging is likely to contribute to the field of forensic psychiatry – as well as which techniques, applications or results are unlikely to be useful in the courtroom.

This endeavor first requires an overview of the scientific underpinnings and methodological implementations of neuroimaging techniques. Part I provides this essential background information. Part II reviews the current state of neuroimaging as it pertains to a number of the psychiatric conditions most often relevant in the civil and criminal legal arenas.

Once this groundwork is laid, the myriad and often thorny issues inherent in attempting to present neuroimaging evidence in the legal context will be discussed. Part III examines the possible applications of (relatively speaking) 'traditional' neuroimaging techniques, i.e., those aimed at clarifying a psychiatric diagnosis, to legal questions in the criminal and civil courts.

In Part IV, we go beyond psychiatric diagnosis to review some of the latest proposed uses of neuroimaging: 'lie detection' and the use of neuroimaging to identify memories and assist in interrogations.

Part V concludes our survey of neuroimaging in the courtroom by examining in detail the practical legal obstacles to its widespread adoption, and discussing the broader legal and ethical concerns raised by these scientific advances. As the techniques evolve, society will be confronted with questions about whether to allow certain types of information to be obtained, under what circumstances and with what safeguards.

There is no doubt that neuroimaging holds great potential for the mental health field, in both the research and clinical domains. In clinical psychiatry, this potential is only beginning to be realized. It is the aim of this book to demonstrate that neuroimaging also holds significant potential value in the legal domain. However, there are many practical as well as ethical questions which the legal system, and by extension society as a whole, must deal with in order to guard against misuse and to foster the proper use of these revolutionary techniques.

Joseph R. Simpson

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