



While justice strives to be impartial, it is never blind. It requires the most penetrating insight: into the human mind.

In the United States and many other nations, criminal culpability (legal responsibility) usually requires not just a guilty act but a guilty mind. The same harmful act can call for different charges and punishments, depending on a person's state of mind at the time of the act, his cognitive capacities, or his ability to control his behavior.

Traditionally, judges and juries have based these determinations on narrative testimony and behavior. But dramatic advances in brain science, technology, and analytic techniques hold promise of a new approach. Already, lawyers are seeking to bring neuroscience evidence into the courtroom. Conscientious judges and juries struggle to understand the science, apply the rules of evidence, and follow the evidence to a just verdict and an appropriate sentence.

If neuroscience is going to play a role in the criminal justice system – where lives, liberty, property, and public safety hang in the balance – it is essential that we get it right. That is the aim of the MacArthur Foundation Research Network on Law and Neuroscience.

THE NETWORK

The Network is undertaking the first comprehensive investigation of the intersection of law and neuroscience. Neither champion nor critic, the Network has two overarching goals: to help the legal system avoid misuse of neuroscience, and to explore the potential of neuroscience to improve the reliability, fairness, rationality, and effectiveness of the criminal justice system.

The Network brings together leading researchers and practitioners from the fields of neuroscience, psychology, psychiatry, law (judges, attorneys, and legal scholars), neuroimaging, statistics, computational science, public policy, social science, and philosophy. Interdisciplinary, multi-institutional, and deeply collaborative, the Network gives researchers the benefit of multiple perspectives, toolkits, and bodies of knowledge. It enlists the expertise of legal and moral thinkers to help scientists design research to address the most fundamental and pressing concerns in the practice of criminal justice. And it offers the legal community guidance on how to use neuroscience responsibly and fairly as this emerging field continues to develop.

The Network's research follows three major themes:

+ Mental states: investigating legally relevant mental states, knowledge, and decision-making processes in defendants, witnesses, jurors, and judges.

+ Adolescent Development: exploring the relationship between brain development and cognitive capacities in juveniles.

+ **Evidence:** assessing how to draw inferences about individuals from group-based neuroscience data, and how that information can be used in court.

MENTAL STATES

Detecting Lies and Memories

Seeking the truth is at once the most fundamental and the most difficult task of the criminal justice system. From arrest to sentencing, participants are challenged to decide whether suspects and witnesses are telling the truth, engaging in deliberate deception, or being sincere yet mistaken.

Can neuroscience identify brain processes associated with lying and remembering? Several companies in the U.S. apparently believe so, and offer “lie detection” based on functional magnetic resonance imaging (fMRI). Attorneys in a few cases have attempted to introduce the outcomes of these tests as courtroom evidence; to date, the courts have viewed such efforts as premature.

The Network is assessing fMRI technology in ways that specifically address its use in the criminal justice system. Looking at cognitive and emotional factors that are often present when people remember or lie in justice-related contexts, researchers seek answers to questions like these:

- + Can brain activity tell us whether an individual accurately recognizes a person whose face she has seen or an event she has witnessed?
- + Can individuals use countermeasures to fake or suppress such recognition?
- + What are the effects of memory practice and the age or strength of a memory on recognition-related brain activity?
- + Do emotional factors such as motivation and reward, threat and stress, alter the ability to identify a true memory?
- + Can we define precisely what neuroscience can and can't tell us about detecting lies and memories?

Distinguishing Levels of Culpability

Imagine a woman has been caught entering the U.S. carrying a suitcase containing drugs. The act is undeniable. But did she purposefully set out to

smuggle drugs? Did she suspect there were drugs in the suitcase but then agree to carry it anyway? How certain was she? Or did she agree to carry a suitcase without considering what might be in it?

The answers to these questions will likely determine the defendant's fate. Under the widely influential Model Penal Code, a judge or jury needs to distinguish among four basic mental states – purpose, knowledge, recklessness, and negligence – in order to decide whether the defendant is guilty and what punishment to impose. In everyday interactions, human beings are fairly good at inferring the mental states of others. But our accuracy is imperfect, our biases often unacknowledged – and a great deal is at stake in criminal cases, for the public as well as the defendant. Finding more objective markers for mental states could be a major advance in promoting justice.

Network researchers are looking for tools that can help identify mental states on the basis of brain data. Among the questions they are asking:

- + Are there empirical differences among the four mental states described in the Modern Penal Code? Is there a better framework the courts should use?
- + How is culpability affected if the person has a complicating condition like a brain injury or mental illness? Can neuroscience lead to better, fairer treatment in applying criminal law to these individuals?
- + Can neuroscience help us assess the probability that a person in a certain situation knew a fact or circumstance existed, or was aware of a risk that it existed?
- + Can neural activity distinguish awareness that one is committing an illicit act from awareness that one will be punished if caught?

Deciding on Appropriate Punishment

The previous topics deal primarily with the mind of a defendant or witness. But it is lawyers, judges, and juries who determine the defendant's fate: Is a killing murder or manslaughter? Should a convicted murderer receive the death penalty or a life sentence? Should a convicted burglar be punished with a term of imprisonment or with probation? The

Network is interested in how people assess a defendant's mental state – his knowledge and intent – and how they decide on a suitable punishment.

Earlier work by Network members suggested we are fairly good at identifying some states, much worse at others. Researchers are now conducting a variety of imaging and behavioral studies aimed at improving our ability to sort out types of guilty minds and apply appropriate punishments. They are asking:

- + Why do people have difficulties distinguishing among some mental states? How do brain signals vary when people make those distinctions?
- + How do age, race, and sex affect people's assessments of mental state and the associated punishment?
- + How do people take into account what a defendant knew when committing an illegal act, and how is that reflected in brain activity?
- + What happens in the brain as people consider mental states and different levels of harm in meting out punishment? To what extent are these processed independently or together?

ADOLESCENT DEVELOPMENT

Analyzing the Adolescent Brain

The adolescent mind is different from that of an adult – in ways that can make youths less blameworthy before the law, and more amenable to rehabilitation. The Supreme Court affirmed this in a series of decisions outlawing the death penalty for juveniles and putting tight restrictions on juvenile sentences of life without parole. While the decisions were based primarily on behavioral research, the courts are increasingly looking to neuroscience for guidance in responding to juvenile offenders.

Psychological studies show that teenagers are reckless and impulsive, less able than adults to recognize risks and think about consequences, more susceptible to peer influence. How are reckless and impulsive behaviors reflected in brain processes, and how do those processes change as an adolescent matures? Few studies have examined these questions.

Network members are now taking on the challenge. Using fMRI along with psychological studies, they

are examining subjects from pre-adolescents to young adults as they deal with a variety of decisions. Researchers are looking for the neural correlates of specific psychological capacities that the courts use to determine criminal responsibility – impulse control, sensation-seeking, decision-making – and how they are affected by emotionally or socially charged situations.

These studies could have a broad impact on the treatment of juvenile offenders. They could eventually help practitioners assign levels of culpability; decide whether to process a youth as a juvenile or an adult; assess whether a youth is likely to grow out of antisocial behavior (as most do); and align individual needs with the most effective treatment.

EVIDENCE

Applying Group Data to Individual Cases

Scientists typically study groups of individuals to build general knowledge about populations. The law, by contrast, is often concerned with individual people in specific situations; any given case may or may not fit the description derived from scientific studies. How to apply group-derived data to decisions about individuals is a key issue that has never been systematically studied by the scientific or legal communities.

The Network is leading the way, exploring fundamental questions that reach beyond the intersection of neuroscience and the law: How do we weigh empirical evidence, values-based considerations, and other factors in decision-making? How can we resolve miscommunication between science and law or public policy?

More specifically, members are asking:

- + When and how should expert testimony be used in court? How can judges rule on the admissibility of highly technical evidence? How do they weigh its value against its potentially prejudicial effects?
- + How should neuroscience be used in ruling in or out specific causes of an act?
- + How can scientific uncertainty and probabilities be explained to non-scientists in a legal context, where it is essential to show not just that

something *could* have caused the act, but that it almost certainly *did* so?

- + Can neuroscience be helpful in predicting an individual's future behavior, particularly the risk of violence?
- + How can we design neuroscience studies to answer these questions?

EDUCATION AND OUTREACH

The Network's central concern is to provide information that can be put to use in the criminal justice system. To support that mission, the Network disseminates its findings to general audiences, researchers, practitioners, and organizations, in the U.S. and internationally, who are interested in the intersection of law and neuroscience. The Network also actively seeks feedback from these communities to help refine and expand its work and make it as useful as possible.

The Network supports education and outreach by sponsoring conferences and symposia; publishing briefs, articles, and books, including a textbook on law and neuroscience; and facilitating appropriate and accurate media coverage of its work. Online communications are especially important. The Network's website, lawneuro.org, allows anyone to learn more about ongoing research, access publications and bibliographies, subscribe to the e-newsletter [Neurolaw News](#), and find out about conferences and other outreach activities. It continually seeks new partnerships and funding opportunities to help it continue its work beyond the current grant.

LOOKING FORWARD

Neuroscience is unlikely to supplant thoughtful human judgment in the courtroom. No scanner will reveal precisely what a person was thinking when she committed an act, nor will technology replace jurors and judges. Criminal responsibility and punishment are fundamentally moral, not scientific, issues. What neuroscience can do is provide information to help human beings make decisions that are as reliable and as fair as they can be.

Neuroscience can provide insights about how human brains work and how a particular person's brain is working. It can help us understand decisions and behaviors that contribute to criminal acts and that influence legal decision-making. Ultimately, it can help us find more effective approaches to punishment and rehabilitation.

Through its work, the Network aims to spark further research, discussion, and education that will help create a safer and more just society.