



Neuroscience and the Law

New discoveries in neuroscience intersect with law making, criminal punishment, and the development of new rehabilitative strategies.

A new understanding of the neurobiology of behavior is emerging. Societies can increasingly leverage this base of scientific information to design modern, evidence-based policy. Questions at the interface of law and neuroscience include: (a) Is it a legitimate defense to claim that a tumor or a brain injury mitigates a crime?; (b) How do the brains of minors differ from adult brains in their capacity for decision-making and impulse control?; (c) Can neuroscience inform sentencing guidelines by offering better prediction of recidivism?; (d) Can new brain imaging technologies be leveraged for new methods of rehabilitation?; (e) Who should have access to information about our brains?; and (f) How should juries assess culpability when most behaviors are driven by unconscious systems of the brain?

There are an increasing number of contact points between neuroscience and the law. Thanks in part to technical advances that were originally developed for disease diagnosis, we can peer into functioning human brains under circumstances of thinking, deception, and decision-making. Because states of mind are the product of states of the brain, neuroscience has begun to rigorously address questions that were once only in the domain of philosophers and psychologists, questions such as the neural underpinnings of criminal behavior.

Answers to such questions have the capacity to shape the future of legal theory. The law needs neuroscience to evolve. Neuroscience, it turns out, also needs the law, not least because the law has been running *in vivo* experiments on real humans for millennia, while neuroscience, only a few decades old, is still in the stage of simplified experiments in the laboratory. Thus, much of the wisdom that has

been crystallized into legal structure can be drawn upon as a guidebook on how people actually behave. The meeting of law and neuroscience provides an opportunity for both to improve.¹

In this article we will turn to several examples of the intersections between the fields. One of the most discussed is the issue of free will. In modern times, relevant questions are posed something like this: Is the brain deterministic? Is the mind nothing but an emergent property of machine-like pieces and parts? Is volition an illusion?

While these questions are sometimes difficult to answer, there is good reason to ask them. Thousands of natural experiments with brain tumors, degenerative disorders, drug addictions and traumatic brain injury illustrate a fundamental principle: when the brain is physically changed, the person is mentally changed. In fact, the physical and mental are so closely allied that they appear, in the view of modern science, to be identical. When one experiences damage to parts of one's brain, personalities can change so completely that there may be no meaningful vestige of the "original" person. Moreover, almost all of the activity in the vast, complex system of the brain occurs below the level of conscious awareness or access, meaning that people are generally not aware of all the factors that drive their behavior.²

The question for law is what this all means for the notion of culpability. If the conscious mind is not the captain of the brain, but merely a passenger along for the ride, to what extent is someone who "chooses" crime culpable? After all, the legal system rests on an assumption that we are practical reasoners—that is, free to choose how we act. But on the other side of the argument is neuroscience, which points out that naturally occurring pathologies—especially to the frontal lobes—cause humans to lose proper decision-making, morality, and impulse control.³ If some parts of your behavior are beyond your control, might that be true for most or all of it?

These issues arise when we look at

criminals such as Charles Whitman, the Texas Tower shooter, who upon autopsy was found to have a brain tumor pressing upon a part of his brain called the amygdala, a part involved in the expression of aggression. Had he survived, would this (should this?) have mitigated his responsibility? Or take the case of Patrizia Reggiani, who ordered the murder of her fashion heir ex-husband, Maurizio Gucci. At her trial in 1998 (and again in 2004), her lawyers claimed she had acted under the influence of a frontal lobe brain tumor that had changed her personality. Should this let her off the hook?

A natural concern is that a deeper understanding of the brain will allow unfettered biological mitigation—in other words, that explanation will lead to exculpation. I suggest this fear is not needed. A neural understanding of behaviors will lead to better prediction of recidivism, a rational basis of sentencing, and customized rehabilitation. Even with a deep understanding of the brain, we will not stop sentencing criminals; we will not fail to assign societal values to behaviors. Instead, the main consequence of science may be to modify the way we sentence. Currently, our patterns of punishment rest on a bedrock of personal volition and the attendant culpability. But a shift in the notion of practical reasoning may suggest a move toward more forward-thinking legislation,^{4,5} in which prison terms are predicated on the risk of recidivism rather than the seeking of just deserts. More generally, the legal system could concentrate on structuring positive and negative incentives to take better advantage of our inborn neural mechanisms.⁶

New Technologies: Horizons and Limitations

We'll first turn to one of the technologies that neuroscience offers for understanding human brains beyond their behavioral output. Magnetic resonance imaging (MRI) is a scanning technology which produces a high resolution snapshot of the brain's structure and anatomy, allowing a search for abnormalities.

A variant of this technology, functional magnetic resonance imaging (fMRI), measures blood oxygenation throughout the brain to identify changes in neural activity. This latter technology has made a dramatic (and debated) entrance into the legal world, affording for the first time an opportunity to seek distinct neural signatures for antisocial, deceptive or violent behavior, opening the door to predictive action and the capacity to assess rehabilitation. For example, Adrian Raine and his colleagues have studied the patterns of neural activity in murderers' brains in the hopes of finding distinguishing features.⁷ MRI is revolutionizing our ability to see how humans think.

But the new opportunity has to be viewed with the proper caveats. For all its power, brain imaging remains in early stages, and the attractive false-color images of the brain may hold more sway in the public eye than they should. In other words, jurors might be persuaded that pictures of the brain don't lie.⁸ The real concern is not whether the pictures lie, but the extent to which they can reveal useful information about human behavior over a range of complex human circumstances.

Moreover, although behavioral problems reside in the brain, they are not always measurable. Behavior can be modified by subtle brain abnormalities, tiny changes in the genetic code, small imbalances of

hormones or neurotransmitter levels, and experience-dictated changes in genetic expression (a field known as epigenetics). All these abnormalities are manifest in the state of the brain, but they may not be detectable with our current technologies. Unfortunately, there is undue pressure on psychiatrists and neuroscientists to decide whether there is something abnormal about the brain of the defendant. One approach that could circumvent this problem is proposed by the neuroscientist Wolf Singer. He suggests that the act of committing a crime is all the evidence we need to assume brain abnormality.⁹ Whether this view should be adopted is open for debate, but it illustrates the problem of having a great technology that is not yet great enough. Nonetheless, even with these important caveats in mind, there are several arenas in which neuroscience can contact law in the immediate future. We turn to eight of them here.

Better Prediction of Criminal Behavior

There is a new potential to use detailed combinations of behavioral tests and neuroimaging to better predict recidivism. Predictions are often employed as a basis in sentencing (for example, with sex offenders); however, currently they are assessed by questionnaires that can allow false answering and personal data that can be difficult to verify. Could such tests be

improved by peeking inside the skull?

Obviously, the factors that lead to recidivism are complex, and prediction can never be perfect; nonetheless, the numbers can be improved a good deal above their current state. If a community believes that sentencing can be fruitfully based on these probabilities, the onus is on that community to use its best tools for prediction. There are serious ethical issues to consider here. If this seems like a Pandora's Box—it is. But it's not a new one. We can learn valuable lessons from genetics, a field that is at least a decade ahead of neuroscience in tackling many of these issues.

Rehabilitation

There is the exciting possibility that neuroscience will be able to contribute new methods for criminal rehabilitation in a minimally invasive manner. To give an example, we must first point out a misunderstanding between neuroscience and law. The critical issue is that the brain is made of many component parts (neuroscientists sometimes refer to the mind as a "society" of smaller parts¹⁰). These parts battle to control decisions, and the outcome of the battle determines the action. This is why you can argue with yourself, disagree with yourself, become angry with yourself for eating the chocolate cake, and so on. The deep problem is that the legal

Law Offices of Richard H. Elliott



Accepting referrals in a wide variety of plaintiffs' investment and securities fraud claims, including:

- Suitability Claims
- Variable Annuities
- 72(t) Income Plans
- IRA Rollovers
- Broker Fraud

Please call for more information about our extensive experience in investment and securities arbitration and litigation.

4709 WEST LOVERS LANE
DALLAS, TX
214-358-7600

402 WEST MAIN STREET
FREDERICKSBURG, TX
830-997-7715

RichardElliottAttorney.com

Board Certified in Civil Trial Law and Personal Injury Trial Law by the Texas Board of Legal Specialization



Commerce Towers

There has never been
a better time
to live downtown.

- On Metro rail and tunnel
- Short walk to Discovery Green Park, new Pavilions Shopping, theater district, and sports stadiums

Over 50 luxurious floor plans
\$400's to over \$2 million

Commerce Towers • 914 Main Street • Houston, Texas • 77002
713-650-3900 WWW.COMMERCETOWERS.COM



system still refers to 'the mind' (as in the *actus reus* test: "to ensure that nothing is interfering with the ability of the *mind* to control the way in which the body is moving"). It is difficult to say what the mind is, inasmuch as a person is the sum total of the internally battling troops. We generally end up punishing the entire person for acts that parts of the brain may not have wanted to do.¹¹

Civil Law

Beyond criminal law, neuroscience contacts civil issues such as competence. At what point should a patient be ruled to have diminished mental capacity? Who gets to make the ruling? Does this depend on his original capacity? And there are deeper questions about capacity, such as whether a person of average intelligence is competent to enter potentially detrimental agreements that are too complex for them to understand (such as certain subprime mortgage offers and their attendant consequences¹²).

Juror's Brains

Neuroscience will not only shed light on the criminal's brain, but also on the juror's brain. Psychology studies show that humans are generally wired for retributivism—that is, an eye-for-an-eye mentality. In fact, in what is known as "altruistic punishment," people will ensure a cheater gets his just deserts by giving up their own resources to see it happen, even when they are not the aggrieved party. This drive for punishment, in combination with the theory of deterrence, navigates much of our sentencing. But there are alternative models: sentencing based on probability of recidivism, as discussed above. Moreover, many jurors harbor a desire to punish, but some do not. What is the difference in their brains? How do their brains interact during deliberation? And here's an interesting thought experiment: if a criminal could be perfectly rehabilitated in a week, would our society accept it, or would we still want to see him punished?

Lie Detection

At least two companies are attempting to leverage brain imaging technologies to build a better lie detector. If the companies' claims pan out, these technologies may offer better detection than the traditional polygraph test, but they will face the same problem that has always existed: we have little scientific understanding of what a lie is, not to mention the problem that someone can tell the truth but be factually wrong.¹³

Bias Detection

Your brain may harbor automatic and unconscious associations between two concepts—for example, a particular ethnicity and a negative view. With a simple reaction time test called the Implicit Association Test (IAT), these associations can be teased out.¹⁴ Could such tests of implicit biases or racism, sometimes unbeknownst to even the holder of these biases, be admitted as evidence?



a professional corporation

FIZER BECK WEBSTER BENTLEY & SCROGGINS

IS PLEASED TO ANNOUNCE, EFFECTIVE APRIL 28, 2008,
THE FIRM IS RELOCATING TO

1330 Post Oak Boulevard, Suite 2900 • Houston, Texas 77056
Telephone: (713) 840-7710 • Fax: (713) 963-8469
www.fizerbeck.com

AND CONGRATULATES

KRISTI N. ELSOM

ON BEING NAMED SHAREHOLDER IN THE FIRM

ALSO, THE FOLLOWING ATTORNEYS HAVE RECENTLY JOINED THE FIRM AS ASSOCIATES

KARLA ALVAREZ
STEVE A. ARAIZA

ALLEN P. BERTIN
NICOLE R. PIELOP

HARRY W. WOLFF, III

Modifying the Brain

In the same way that elite athletes struggle with the morality and legality of taking drugs to enhance their physical skills, similar struggles are in our near future with the prospect of cognitive enhancers. Such drugs, known technically as nootropic drugs (and less formally as smart drugs, or brain enhancers) promise to someday revolutionize memory, IQ and attention. The modern day precursors of these drugs (e.g. caffeine and Ritalin) may appear tame in comparison to what will arrive with increasing knowledge of the fundamental neural principles of learning and memory. The concern is that such drugs will increase the gap between the rich and poor, for example with those who can afford to obtain them before taking the LSAT and those who cannot.

Brain Death

A body can often be kept alive indefinitely, but science and the law try to find a line to categorize when the brain—and thus the fundamental personality of a person—is beyond repair or hope for recovery. The current definition of brain death has been arrived at through years of interplay between neurology, law, and ethics; however, some suggest that it could be improved to include not just respiration, but meaningful cognition.

A currently exciting area of research is the use of brain imaging to look for active cognitive signatures in people who are otherwise in a non-communicative, vegetative state, opening the question of whether they are conscious “in there” to scientific inquiry.¹⁵

Conclusions

Effective law requires effective behavioral models: understanding not simply how we would like people to behave, but how they actually behave and why.¹⁶ To this end, a good deal of work is called for at the science/law interface. A challenge for practitioners is that scientists often explore the gray area of multiple possibilities, whereas lawyers are forced to reach definite conclusions. As a result, scientists will often irritate lawyers, and lawyers will make scientists worry.¹⁷ But allegiances will have to be forged to take modern neuroscience beyond the walls of the lab, and to bring law up to speed with modern knowledge. Only through these alliances can we realize the dream of a biologically informed jurisprudence. ✎

David Eagleman, Ph.D., is a neuroscientist at Baylor College of Medicine and director of the Initiative on Law, Brains and Behavior. He holds joint appointments in the departments of Neuroscience and Psychiatry.

Endnotes

1. With the goal of finding the fertile nexus between the two fields, Baylor College of Medicine has launched an Initiative on Law, Brains and Behavior. More information on Baylor College of Medicine's Initiative on Law, Brains and Behavior can be found at <http://neuro.bcm.edu/eagleman/neurolaw>.
2. David M. Eagleman. *Dethronement: The Secret Life of the Unconscious Brain*. New York: Pantheon Books. In press (2009).
3. R. M. Sapolsky. *The frontal cortex and the criminal justice system*. *Phil. Trans. R. Soc. Lond. B* 359, 1787–1796. 2004 (doi:10.1098/rstb.2004.1547)
4. Greene, J. & Cohen, J. 2004 For the law, neuroscience changes nothing and everything. *Phil. Trans. R. Soc. Lond. B* 359, 1775–1785. (doi:10.1098/rstb.2004.1546)
5. Deborah W. Denno, *Legal Implications of Genetics and Crime Research*, in *GENETICS OF CRIMINAL AND ANTISOCIAL BEHAVIOUR* 248, 248-64 (Gregory Bock & Jamie Goode eds., 1996)
6. Chorvat, Terrence R. and McCabe, Kevin, “The Brain and the Law” *George Mason Law & Economics Research Paper No. 04-33* Available at SSRN: <http://ssrn.com/abstract=577821>
7. Scarpa and Raine (2003). *The psychophysiology of antisocial behavior: Interactions with environmental experiences*. In: *Biosocial Criminology: Challenging Environmentalism's Supremacy* Nova Science.
8. M. J. Farah. *Neuroethics: The practical and the philosophical*. *Trends in Cognitive Science*, 9, 34, (2005).
9. Keiner kann anders, als er ist, by Wolf Singer, *Frankfurter Allgemeine Zeitung*, January 8 2004 (original essay in German); also see *How Free Are You? The Determinism Problem*, by Ted Honderich (Oxford University Press, 2002)
10. Minsky, Marvin. *The Society of Mind*. Simon & Schuster. (1988).
11. With this background in mind, laboratory at Baylor College of Medicine is launching new experiments using revolutionary new real-time feedback techniques in neuroimaging. The rehabilitation project is in collaboration with my colleague Dr. Steven LaConte, and students in the initiative such as Jyotpal Singh. If successful, such techniques will allow users to strengthen the influence of their prefrontal cortex, a part of the brain that specializes in long term decision-making and impulse control. As of this writing, this ‘prefrontal gym’ is science fiction. But it may not be for long; check our website in six months for progress. If the technique is successful, it will change the personality of a person as little as possible, merely allowing the improvement of long-term consideration and control over impulsivity. This technique can only hope to rehabilitate a subpopulation of criminals (those who know the proper course of action but cannot resist impulsive behavior), but it introduces a new style of rehabilitation that may lead to others in the near future.
12. Mixon, John. Personal communication
13. *Neuroscience and the Law: Brain, Mind, and the Scales of Justice*. Ed: Brent Garland.
14. Rudman, L. A., Greenwald, A. G., Mellott, D. S., & Schwartz, J. L. K. (1999). *Measuring the automatic components of prejudice: Flexibility and generality of the Implicit Association Test*. *Social Cognition*, 17, 437-465; for a countervailing view, see Blanton, H., & Jaccard, J. (2006). *Arbitrary metrics in psychology*. *American Psychologist*, 61, 27 - 41.
15. Adrian M. Owen, Martin R. Coleman, Melanie Boly, Matthew H. Davis, Steven Laureys, and John D. Pickard (2006). *Detecting Awareness in the Vegetative State*. *Science* 313 (5792), 1402.
16. Jones, O. D. (2004). *Law, evolution and the brain: applications and open questions*. *Phil. Trans. R. Soc. Lond. B* 359, 1697–1707
17. S. Zeki and O. R. Goodenough. *Law and the brain: introduction*. *Phil. Trans. R. Soc. Lond. B* (2004) 359, 1661–1665. (2004).

LAW OFFICES OF
THURLOW
& ASSOCIATES, P.C.

NON-SUBSCRIBER WORKERS COMPENSATION CASES

Texas is the only State that does not require employers to carry state worker's compensation coverage for their employees.

If your client's employer is a “non-subscriber” and there is a serious injury caused by the employer's negligence, call us – **we can help!**

THURLOW & ASSOCIATES, P.C.
440 Louisiana #1200 • Houston, TX 77002 • 713.224.6774

Paralegal Certificate Program

Information Session **Wednesday, July 16 at 6:00 p.m.**
RSVP at www.riceparalegal.com

\$300 discount for those who register at the information session

The Rice Paralegal Certificate Program, offered by the Susanne M. Glasscock School of Continuing Studies, is designed for professionals with a bachelor's degree who are interested in a career in the legal field. The rigorous course of study is a well-defined skills-based program, allowing you to complete your studies in about five months in a convenient evening format. When you earn the Rice Paralegal Certificate, you are ready to enter the paralegal field.

Classes begin August 18, 2008



www.riceparalegal.com 713-348-4803

