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Blame the Brain: Neuroscience for Action in Criminal Courtrooms

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Abstract

Between 2005 and 2012, the number of judicial opinions that mention brain science evidence in the criminal justice system more than doubled (Farahany 2015). This article outlines the significance of some major STS theorists (Latour 1993, Galison 1997, Dumit 2004, Haraway 1991, Knorr-Cetina 1999) as a means of examining the ways in which STS perspectives can, if integrated into criminal courtrooms, enrich our understanding of contemporary neuroscience and society. In this paper, I trace the co-production of neuroscientific and legal knowledges through a study of functional magnetic resonance imaging (fMRI) scans in U.S. criminal courtrooms. In following the social life of such brain scans, I demonstrate how brain images are assembled, how they travel from one context (e.g. a lab) to another (e.g., a courtroom or a magazine), and how they are put to persuasive use in legal contexts. I argue law-science interactions in U.S. courtrooms have become sites of epistemic contestations over meanings of truth, justice, personhood, and expert knowledges in U.S. society and politics. I apply Sheila Jasanoff's concept of "serviceable truth" to two cases in which brain images figure significantly in the court's proceedings: a 2006 case of child pornography popularized in *Radiolab* and a 1985 case of John Hinckley, the man who in 1981 attempted to murder Ronald Reagan. In doing so, I offer new insights into how legal and neuroscientific experts and laypeople alike might navigate the uneven diffusion of scientific knowledge in U.S. criminal proceedings.

Keywords: neuroscience, U.S. legal system, STS, brain scans, expert knowledges, epistemic cultures

> "[We will one day have] extremely high-resolution scanners than can simultaneously track… every neuron in the brain [such that] neural events alone are causally responsible for behavior." (Joshua Greene and Jonathan Cohen, "For the Law, Neuroscience Changes Nothing and Everything," p. 218)

> "Neuroscience is simply the most recent mechanistic causal science that appears deterministically to explain behavior. Neuroscience adds nothing new… [and] poses no threat to legal responsibility." (Stephen J. Morse, "Lost in Translation?" p. 534)

> "Struggles over what will count as rational
> accounts of the world are struggles over how to see." (Donna Haraway, "Situated knowledges," p. 194)

Introduction

Between 2005 and 2012, the number of judicial opinions that mention neuroscientific evidence more than doubled (Farahany 2015). Neuroscientific evidence carries significant weight in defining who we are (Racine et al. 2010) and in defining what counts as scientifically credible knowledge (McCabe and Castel 2008). Moreover, the brain is a deeply meaningful organ, represented as the center of mind and self (Rose 2007). Yet the rise of contemporary neuroscience has not come without conflict, especially with regard to criminal law. Indeed, what *counts* as reliable and relevant scientific knowledge has come under deep contest in contemporary U.S. courtrooms. Central debates in neuroscience-law interactions have focused around two general claims: on one hand, Joshua Greene and Jonathan Cohen argue that advances in neuroscience will eventually lead to an end of blaming people for their actions, transforming legal understandings of responsibility and personhood. Stephen J. Morse, in contrast, argues that the kinds of advances Greene and Cohen imagine are wholly unsubstantiated and potentially dangerous, and should not therefore change the law or its foundational precepts. How should we conceptualize these intradisciplinary epistemic conflicts (Knorr Cetina 1999)? In this paper, I trace the co-production of neuroscientific and legal knowledges through a study of functional magnetic resonance imaging (fMRI) scans. In following the social life of such brain scans, I demonstrate how brain images are put together, how they travel from one context (e.g. a lab) to another (e.g., a courtroom or a magazine), and how they are put to persuasive use in legal contexts.

I argue law-science interactions in the U.S. courtroom have become a site of epistemic contestation over meanings of truth, justice, personhood, and expert knowledges in U.S. society and politics. In reframing this epistemic contest towards a "serviceable truth" (Jasanoff 2015) of neurolegal knowledge in action, I apply STS perspectives towards how legal and neuroscientific experts and laypeople alike might navigate the uneven diffusion of knowledge in U.S. criminal proceedings.

Part II: Ways of Seeing

Situated knowledges in neuroscience and criminal law

In 2012, Kevin[1] was raided and arrested by federal agents for purchasing and downloading child pornography (Radiolab 2013). Kevin had no prior criminal record, and had never been arrested. But Kevin, in a twist of events, had just undergone invasive brain surgery to treat his chronic epilepsy, a surgery that in months prior to Kevin's arrest had led to, as

[1] Kevin is a pseudonym.

Kevin's wife describes it, a litany of bizarre behavior and personality changes: uncontrolled overeating, obsessive piano playing, increased sexual appetite (Radiolab 2013). In the trial, Kevin's lawyer, alongside his smartly-dressed doctor, neuroscientist Orrin Devinsky, made the provocative claim that what happened to Kevin could happen to *any of us* under similar circumstances and that it wasn't entirely *his* fault. *His brain made him do it*, they essentially argued. Despite these claims, prosecutor Lee Vartan believed Kevin was still responsible and should serve the maximum sentence. So, was Kevin *responsible*? Can an *abnormal brain* really *make* someone commit a federal crime? What might this mean for the criminal justice system and, more broadly, constructions of personhood and self?

To untangle this question, I conduct an STS analysis on neuroscientific and legal knowledge-making practices: how do members of each group understand a normative claim like *truth* or *responsibility*? What kinds of knowledge does each group consider reliable and authoritative? How are these knowledges performed through informal and formal institutions? As STS scholars have productively demonstrated, any truth claim is situated within particular practices of knowledge-making that can be characterized as "epistemic cultures" (Knorr-Cetina 1999), relying on specific traditions of evidence (Galison 1997). Reading the epistemic cultures of legal and neuroscientific knowledge production—and the assumptions upon which these modes of truth-making are founded—provides insight into the fact-making process and each group's own attempts to use—or "purify"—science as an object of authority and argumentation (Latour 1993).

The rise of neurodeterminism

Neuroscientist Orrin Devinsky, Kevin's doctor, took the pulpit in Kevin's trial proceedings to claim that what happened to Kevin could happen to *anyone.* Using functional magnetic resonance imaging (fMRI), he showed the courts images of Kevin's brain—the images were persuasive; in the end, Kevin avoided the maximum sentence, and his sympathetic jury reduced his prison time by decades (Radiolab 2013). Indeed, neuroimaging has been hailed as the next best set of technologies for understanding human behavior, especially in criminal proceedings. Equipped with increasingly high-powered techniques like fMRI and the electroencephalography (EEG)-based technology of 'Brain Fingerprinting,' a new brand of what some call "neurodeterminism" appears to be on the rise.

With regards to criminal justice, the neurosciences appear to be mounting an ever-more compelling argument *against* traditional and normative notions of legal responsibility, free will, and accountability. This has led to some in the field to call for a "eulogy of responsibility" in legal matters (Vincent 2013:3). Joshua Green and Jonathan Cohen argue that new advances in neuroscience demonstrate that "free will, as we ordinarily understand it, is an illusion"—and that lawyers and jurists

should consequently ditch notions of legal responsibility and punishment (Green and Cohen 2004). Robert Sapolsky, a professor at Stanford, imagines a "world of criminal justice in which there is no blame, but only prior causes" (Sapolsky 2004). Researcher Semir Zeki published a report on "hate circuits" in our brains and, alongside his research partners Harris and Goodenough, posits a "future where brain science can resolve international political and economic conflicts" (Zeki 2008). Similarly, neuroscientist David Eagleman imagines a future in which "bad behavior" has a "basic biological explanation… in the same way we think about any physical process, such as diabetes or lung disease" and argues that such understanding will necessarily mean "more juries will place defendants on the not-blameworthy side of the line" (Eagleman 2011).

In the popular imagination, eye-catching headlines on *Vogue* and *Time* reinforce this understanding. Psychologist Cliodhna O'Connor and her colleagues investigated how brain science was reported across 10 years of newspaper coverage and found a steady increase in reporting on the field. They also found patterns in *how* such research was reported: "it was common to encounter the phrase "the [adjective] brain," with the brackets filled by categories like "male," "teenage," "criminal," "addicted," or "gay" (O'Connor 2012). They conclude: in contemporary coverage, "social groups were essentialized and portrayed as wholly internally homogeneous" (O'Conner 2012).

Pop neuroscience and hard neurodeterminists are certainly easy targets for STS critique. Indeed, many neuroscientists themselves—and those in allied fields like psychiatry and psychology—condemn neurodeterminism, calling it "neurohubris," "neuromania," and "neurohype" (Vincent 2013:4). In an effort to debunk such "mindless neuroscience," psychiatrist Sally Satel and psychologist Scott Lilienfeld compiled dozens of "inconclusive" studies, critiquing the "oversimplification, interpretive license, and premature application of brain science in the legal, commercial, clinical, and philosophical domains" (Satel 2013). For these scholars, it appears neuroscience's persuasiveness has come to outstrip the very neuro-experts who make brain images; they can no longer demarcate what their images *mean* as they travel outside the neuroscientific lab and into popular and social spheres, including a particularly consequential sphere: criminal courtrooms.

Legal ways of seeing

Brain images are powerfully persuasive: they are seemingly equipped with both medical and neuroscientific authority and digital and picture-like objectivity. How does the legal apparatus make sense of and respond to this persuasiveness? Certainly, both law and science are concerned with evidence and authority, but who judges this evidence and what counts as reliable and relevant scientific fact in the courtroom comes under deep contest. In this contest, the courts have become a battleground where the

"persuasive, authoritative, and reifying powers" of what Joseph Dumit calls "expert images" are explicitly defined and debated in rigorous ways (Dumit 2004:112). Questions at stake: In what ways does neuroscientific fact assist or deter the law in determining guilt or rendering justice? Who establishes this? At what level of consensus? Who holds neuroscience accountable to its authoritative claims to objectivity? It is important to note that in the realm of neuroimaging, we are dealing with not just fact, but also fact and *value*. Problems arise in what value facts are accorded within the legal apparatus and with what influence such facts have in rendering justice.

First, I examine how the law determines guilt. My aim is to examine the normative understandings of the law as an institution and to explore how knowledge becomes "usable" and "useful" in a court of law—in short, to explore how actors and networks in the criminal courts "see" (Haraway 2015)[2]. As Sheila Jasanoff demonstrates, the law as an epistemic culture often "accords precedence to its own institutional self-understandings over deference to science" (Jasanoff 2015:1736). In the United States, the law holds persons guilty—and therefore accountable—if they intended to commit a prohibited act. Mental state—or in legal terms, *mens rea*[3]—is a key determinant of guilt and legal responsibility and is therefore at the heart of how the law sees. Without *mens rea*, the law cannot hold a person criminally responsible. There are, of course, exceptions (acting under duress or legal insanity, for instance). But at its core, the legal apparatus prescribes to what Stephen J. Morse calls a "folk psychologist view of human behavior" that causally explains behavior by "mental states such as desires, believes, intentions, willings and plans" (Morse 2011:530). Morse concedes that while biological and sociological variables are at play, determinations of *mens reas*[3] are "fundamental" (Morse 2011:530). Within this framework, biological causes are accorded no special weight in eyes of law. As Satel writes: "the law cares only whether a causal factor, no matter its nature, produced impairment so substantial as to deprive people of their rationality" (Satel 2013). Indeed, for the law, "brains do not convince each other; people do" (Morse 2011:530).

In the process of determining *mens rea*, trial judges are explicit gatekeepers for determining the sorts of facts that are admissible. Through *Daubert* hearings, trial judges decide whether scientific or other technical evidence meets the admissibility criteria set forth by the U.S. Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals*, which requires trial

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[2] For Donna Haraway, all ways of "seeing" and acting in the world are situated, partial, and embodied (Haraway 2015). In this paper, I trace specific ways of seeing and acting upon brain images from legal and neuroscientific standpoints.

[3] *Mens Rea* refers to *criminal intent*: the state of mind statutorily required in order to convict a particular defendant of a particular crime. See, e.g. Staples v. United States, 511 US 600 (1994).

judges to determine whether expert testimony is both "reliable" and "relevant" (*Daubert v Merrell Dow*). Judges making these determinations must consider (1) whether the scientific technique is testable and whether it has been tested; (2) whether the technique has been subjected to peer review and publication; (3) the techniques known or potential error rate; (4) whether there are standards governing the technique's application; and (5) whether the scientific community accepts the technique (*Daubert v Merrell Dow*). The 'general acceptance' standard poses problems, as it leaves largely undefined what comprises the 'relevant scientific community,' as well as how to demarcate established scientific facts from what some lawyers call "junk science." Indeed, some STS scholars argue that *Daubert* represents an impossible effort to delimit "reliable" from "unreliable" expert knowledge (Edmond & Mercer 1998).

Given their gatekeeping role, judges are cautious about allowing neuroimages in courtrooms. The concern is that neuroimaging evidence, imbued with its apparent objectivities and visual powers, has disproportionate prejudicial impact[4]. The legal term "prejudice" involves attitudes toward the evidence – that is, judges are concerned that the prejudicial impact of admitting the neuroscientific evidence might considerably outweigh their probative value. Given the history of brain images in courts, judges have real reason to be concerned by the persuasive nature of brain images. In the infamous trial of John Hinckley, the man who in 1981 attempted to murder Ronald Reagan, Hinckley's defendants moved to introduce brain scans of Hinckely's brain to prove that he had an "abnormal brain" due to schizophrenia (Linder 2002). After much debate, Hinckley's trial judge, Judge Parker, allowed the scans in a diluted and contained fashion: at the far end of the room with limited colors (Linder 2002). Judge Parker's actions in the Hinckley trial demonstrate an understanding about the persuasiveness of brain images as a kind of visual objectivity. Indeed, two years after the Hinckley trial, legal scholar Don DeBenedictis wrote that brain images have considerable power to "dazzle jurors" so much so that one attorney said he was concerned jurors "would be staring at these pretty pictures and just equate all the red colors with crazy colors" (DeBenedictis 1990:30). It seems that images that purport to be about mental state of individuals may come to be read as the decisive fact of a trial: in this case, as conclusive proof of a person's *mens reas* for their actions. The persuasiveness of such images comes down to whether an individual's brain scans can be equated with their *personhood* — that is, whether the jury feels that an abnormal brain necessarily equates to an abnormal, mentally ill *person* (a claim that most neuroscientists dismiss) who is therefore not responsible for their actions.

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[4] Determining "prejudicial effect" of the evidence is at the discretion of the judge. A judge concerned that the prejudicial effect of admitting neuroscientific evidence could invoke Rule 403 to object that evidence is too "prejudicial" to be admitted. The relevant evidence may be excluded if its probative value is substantially outweighed by effects that detract from a fair trial.

These images are so persuasive that both sides of the adversarial system have moved to capitalize on the perceived objective nature of neuroimaging technologies. Writes Nikolas Rose: "Biological arguments seem to enter the courtroom not because legal personhood has become biological, but because defense lawyers, especially in the US, utilize anything they can to defend their clients" (Rose 2000:13). David Faigman, a constitutional law scholar, agrees, writing "lawyers and judges have grown up thinking that social science is soft. Neuroscience gives the courts a hook" (Faigman, quoted in Buchen 2012).

The court's reticence to admit neuroscientific evidence reveals a broader conflict in how legal actors conceptualize the role of science and technology in society. As an institution, the law is caught in a double bind between "factual assertions of science" and the "normative dictates of law" (Jasanoff 2015). This double bind is between the law's structural function of (1) delivering justice, stability, and governance to society, especially to vulnerable populations, and (2) requiring "high-quality" evidence—often from advancements in science and technology—to determine justice in particular cases (Jasanoff 2015). While both legal practitioners and the scientific community make claims concerning the "authority" of their respective epistemic practices in the context of a courtroom, these positions come into conflict with one another and seem at times mutually exclusive. This leads to an "asymmetrical" interaction between science and the law, and actors become engaged in a contest over whose position and norms should be adopted (Jasanoff 2015).

Because this drama takes place in legal settings (i.e. courtrooms), some ways of seeing are rendered permissible in legal procedure and others not. For instance, legal practitioners historically have not deferred to the dominant scientific ways of seeing, because the legal ways of seeing—certain normative commitments to notions such as justice, stability, and protection of vulnerable populations—are given a privileged status in the legal process. In these instances, legal practitioners are not explicitly challenging scientific "objectivity" per se, but rather privileging legal ways of seeing as a more capable mode of weighing societal and normative considerations. As Oren Harmen argues, the law's emphasis on justice and normative assumptions means that culpability should not rest on asymmetrical interactions, but on "normative and ethical considerations rather than on scientific ones" (Harmen 2013).

This is an embodied, situated knowledge of the normative values that guide legal ways of seeing and, in some institutional sense, act as a tool against the unmarked authority of scientific knowledge claims in criminal procedures.

Part III: Lost in Translation: fact-making from the neuroscientific lab to the courtrooms

Now that I have examined the situated knowledges of legal and scientific actors involved, I transition to examining the fMRI "laboratory," tracing

the production of such images in action (Latour & Woolgar, 1979; Knorr-Cetina, 1981; Traweek, 1988). I briefly examine the technical processes at play, and move to explore how brain images move from one context (the lab) into another (the courtroom). In doing so, I demonstrate how brain images are translated to lay audiences, what socio-cultural meanings they lose and pick up in the process, and how neuroimages are mobilized for persuasive use in specific contexts. I argue that the practices, normative values, epistemic cultures, and languages of neuroscience and law are so different that the movement of knowledge from one domain to the other is fundamentally challenging.

Lab Studies: Neuroscience in Action

Brain images are an objective rendering of the physical world—a photograph of what cannot be photographed is made miraculously visible and intact via technologies. Yet in tracing the production of such images, it becomes evident that the brain image's apparent objective status is in fact constructed. Richard Haier, a PET scan operator writes: "as an operator, I can choose the colors on the scale and I can choose the interval on the scale, and I can make a lot of areas black. And that would look very dramatic" (Richard Haier, quoted in Dumit 1995, p. 67). fMRI machines produces a varied set of images by adapting physical data—such as relaxation times—into spatial maps of interior chunks of the body. These machines are accorded a certain non-agentic and objective status: they are understood to passively reproduce reality in its entirety. Yet, as Dumit demonstrates, such machines "leave their mark" to "co-produce the image" (Dumit 2004:119). For Dumit, medical imaging technologies do not simply reproduce a positivist reality; they actively transform and translate a set of relations (i.e. the relationship between personhood and agency) into an 'objective' visual object (i.e. a brain scan). In fact, while looking at brain images, neuroscientists must manipulate digital displays to "manage and make sense of their experimental data" (Alac 2008). In this sense, neuroimages are "dynamical phenomenal objects" that must be enacted and actively constituted at the juncture between the digital world of technology and the human world of embodied action (Alac 2008). Alac writes:

> "In this sense, 'seeing' of fMRI images is an embodied process achieved through a coordination of 'visual' information with the world of meaningful actions and practical problem-solving. In other words, the visibility is not only relative to what goes on inside the practitioner's head or to what is present on the screen. Seeing is tied to actions" (Alac 2008:504).

Seeing is tied to actions. But these actions are not limited to the construction of the image itself; they are also embodied in the assumptions "designed into and read out of the experimental process that reinforce specific notions about human nature" (Dumit 2004). For Dumit, assumptions (about human nature, normality, personhood, the self) can

enter neuroimaging's processual stream at any juncture, from "choosing test subjects and statistical models to deciding which images to publish and how to color them" (Dumit 2004).

Let's examine the case of how brain images come to be labeled as "normal" and "abnormal" via the statistical technologies of medical averaging. "Normal" images selected for display—in courtrooms and in media publications—are in fact "supernormal" aggregates, often juxtaposed as "normal" next to the scans from an individual whose brain regions were *most* different and labeled as "abnormal" (someone with schizophrenia, for example). Supernormal images undergo a process of statistical averaging that subdues the many individual variants among the "supernormals" and produces an even image of "normal" (Dumit 2004). Yet these supernormals, because they are statistical aggregates, tell us less about an individual's alleged normality or abnormality than we might be led to believe (Dumit 2004). This approach assumes implicitly that composite processes can be wholly understood by studying its smaller parts, a notion compatible with some positivist sciences. But the visual effect of the supernormal aggregate is one with powerful visual implications, including: (1) trained eyes, with machines, can always see brain malfunctions, like schizophrenia or depression, (2) that depressed people, for instance, have a certain *kind* of brain, and (3) that depressed people are irrefutably *biologically* different from "normal" people. Associations like these are then presented in the mass media and in courtrooms, where the supplementing text often states what the pictures "show," often not what the data initially indicated (Dumit 2004).

If we trace the trajectory of production and use of brain images, it becomes evident that neuroimaging's gaze is not constituted by a single act of seeing and its consummate representation of a single whole image of the body. Indeed, fMRI images do not mechanically reproduce observed objects, but rather show "different reconfigurations of the body, each of which provide a partial perspective of the body and together constitute the fMRI gaze" (Prasad 2005:292). Amit Prasad calls this act of seeing the "cyborg visuality" of the "medical gaze" in which neuroimaging comes to signify irrefutable objective vision (Prasad 2005:292). I borrow concepts from the field of semiotics, in which Greimas and Courtes refer to brain scans as an instance of *planar semiotics*, or "the ways in which relative to a given culture, certain signs [are judged] to be 'more real' than others" (Greimas and Courtes 1982:150-151). Indeed, there is a whole body of work on visual culture and the semiotic effects of visual objects, including brain scans and other visualized scientific technologies (Barnard 2001; Evans and Hall 1999). Much of it is concerned with interpreting the meaning of visual images, with practices of visuality, or with agency of visual objects. On the agency of visual objects, Haraway writes: "in this technological feast becomes unregulated gluttony; all perspective gives way to infinitely mobile vision, which no longer seems just mythically about the god-trick of seeing

everything from nowhere, but to have put the myth into ordinary practice (Haraway 1991:189). Neuroscience as an institution mobilizes certain forms of visuality (neuroimaging: an 'infinitely mobile vision', a ' view from nowhere,' a 'cyborg visuality') as a "scopic regime" to see and to order the world (Haraway 1991:189).

In conclusion, objects like brain images produced with mechanical assistance both enact and are enacted, both intervene and are intervened upon, through embodied interpreting, even though they may appear to be immediately legible to a layperson. Thus, a theory of the power to make images authoritatively unmarked and objective can be developed, as the image's apparent photographic status and manufactured objectivity overcome its interpreted, agentic, and mutually constituted nature.

Neuroscience in the Courtrooms

Once they leave the laboratory, neuroimages shape social debates, influence courtroom outcomes, and invade the public imagination. In this section, I chart this translation, demonstrating how brain scans, as scientific objects, speak to and build upon our social and cultural dependency on a certain kind of scientific authority. Three issues must be explored, the first two of which I have already discussed: (1) the aggregated status of the referent of brain images, (2) the manufactured objectivity in neuroimaging and (3) the persuasiveness of such images for onlookers. These issues define the ways that brain scans are taken up in popular culture and in the courtroom.

As STS scholars have demonstrated, science is seldom if ever translated into the public domain in a value-neutral process. As scientific facts enter the public domain, they encounter a thick network of cultural meanings and are interpreted through the lens they provide. This context determines how and which aspects of scientific fact travel into public consciousness and get taken up by other disciplines and spheres. The use of what Dumit calls "expert images" in the courtroom is filled with complications like these; the courts, like the worlds around it, are embedded in this network of cultural semiotics that "privileges machines over experts in terms of objectivity, and biology over social causes in agency" (Dumit 2004). The risk is that brain images meant to serve as "mere aids to illustrate testimony" become "an expert's only objective proof" (Dumit 2004). Further, there is danger in brain images no longer serving as a useful reflection of scientific knowledge, but instead as "a binding of fantasies to images and meaning" (de Lauretis 1987:53). These include fantasies of "automation without automators, objectivity without the craft and art and messy humanness of scientists, and neutrality without acknowledging the struggles over human categories like normality, mental illness, insanity, and even variability" (Dumit 2004). This socio-cultural web of meaning necessarily preconfigures and shapes notions of the brain and mind—the brain becomes at the same time an "epistemic object and...an organ of the organism" (Bashi and Sahinol, quoted in Matusall

2011). Indeed, in a historical analysis of brain semiotics, Bruder demonstrates that "each society defines the brain it requires" (Bruder, quoted in Matusall 2011). Interests, for Bruder, shift across time and space from structure to function to the brain in interaction with other brains to changing social notions of family, individual, and agency—all of which influence "how the social is defined that is then located in the brain" (Bruder, quoted in Matusall 2011).

In the courts, neuroknowledge is converted first into a technology (e.g. neuro-stimulation) and then into persuasive, signified legal facts. Yet displaying these "expert images" to a jury stepped only in mass media images of complete differences (and even medical journal images of overstated differences) is likely to be very prejudicial, because "the jury's eyes are cultural ones, not expert ones" (Dumit 2004). As facts travel into courtrooms, what is negotiated is often not the image and the object it represents, but instead the image and its earlier culturalized meanings. At the crux of this relationship is this: the "image that (objectively) speaks for itself and the expert who (subjectively) reads its lips is a desire by the court and by everyone else to reduce ambiguity, to make things clear, and clearly acceptable" (Dumit 2004). But as Dumit and others have demonstrated, this desire is a fantasy space, and reveals perhaps more about our collective socio-cultural anxieties and desires, than it does about notions of legal responsibility or criminal justice. Indeed, the use of neuroscientific expertise as evidence in U.S. court cases is fraught with difficulties like these and more; the translation of knowledges from one sphere to the other is necessarily difficult. Given this difficulty, what would a "serviceable" neuroscience look like—a neuroscience capable of aiding the law in its institutional role in making just and fair determinations of accountability and responsibility?

Part IV: Towards a Serviceable Truth of Neuroscience-Law Interactions

Despite an increase in number of judicial opinions referencing brain scans from 2005-2012, legal scholar Nita Farahany contends it is difficult to measure just how influential neuroscientific evidence is in rendering judicial outcomes given the uniqueness of each case (Farahany 2015). Yet Farahany found that in cases that used neuroscientific evidence, defendants received an advantageous outcome—either through a reduced sentence, a new hearing, or some other positive result—about 20 to 30 percent of the time (Farahany 2015). This figure is significant compared to the 12% of criminal cases reviewed by the U.S. Department of Justice in 2015 in which the defendant was favored (Waters 2015). Percentage-wise, defendants are likely to fair better with neuroscience than without.

A question arises: how should STS scholarship respond to neuroscience in courtrooms? Since its inception, a major project of STS has been to intervene into public debates about science and technology: a science in service of the public and its most pressing controversies. One

usable framework is Sheila Jasanoff's concepts of "cascade of deference" and "serviceable truth." Given that the relationship between science and law is often asymmetrical and privileges science as guaranteeing "truth" in legal decisions, Jasanoff argues STS-law interactions must abandon objective truth towards serviceable truth. While science provides a tremendously powerful way of looking at and shaping the world, it is sometimes fundamentally incapable of resolving claims to truth. Rather than contest claims to the truth, STS perspectives ask decision-makers to recognize that science's role in the legal process is not simply, even preeminently, to provide a mirror of nature. We might use the insights of STS to instead establish the circumstances upon which "reliable knowledge" might be acted in determinations of legal responsibility (Jasanoff, 1730). Jasanoff writes:

> "I propose a cascade of deference as science moves from high to low degrees of certainty and reliability. Four stopping points can be identified for critical reflection on the law-science relationship: objectivity, consensus, precaution, and subsidiarity." (Jasanoff 2015:1725)

The model involves resolving contesting truth claims through a "cascade of deference" moving from high deference to no deference. "Epistemic objectivity," or high deference, involves situations in which the scientific evidence is judged to be rigorous, and therefore has "epistemic primacy" in contest with the law. "Epistemic subsidiarity," or low deference, involves claims in which the law and its normative concerns for justice and representation take precedence over science's claims to authority.

Applying Jasanoff's model to Hinckley's trial in 1998, an STS perspective might allow us to navigate the case as an example of Jasanoff's fourth stopping point: "epistemic subsidiary," in which facts are profoundly contested and no epistemic consensus exists. (Neuroscientists themselves readily dismiss the idea that an individual's brain scans can be equated with their personhood (Dumit 2003)). As Jasanoff argues, when science rests on weaker foundations, the work of the law can reasonably shift toward more normative concerns. Thus, in Hinckley's case, where knowledge was uncertain and precaution was warranted, the law could best serve society's needs by promoting decision makers' use of "technologies of humility"--a strategy that pushes attention from what *can be done* to what *should be done* when "unequal distributive outcomes are at stake" (Jasanoff 2015, 1745). Judge Parker's actions in the Hinckley trial are a useful example of how appraising "epistemic subsidiary" cases might unfold. In permitting the images to appear in court but disallowing a high-contrast coloring, Parker chose to privilege the potential role for normative functions of the law. As minimal or no basis existed to favor one explanation of the scientific facts over another, Judge Parker played a "valuable role by laying down workable rules of epistemic subsidiarity" (Jasanoff 2015, 1749).

In Kevin's case, the scientific evidence rests on more authoritative but still contested grounds, somewhere between the second or third stopping points: "epistemic consensus" or "epistemic precaution." The "consensus" stopping point is an only slightly weaker basis for demanding deference from the first point, objectivity. Here, the argument is not that science has been able to access unvarnished truth, but rather that relevant scientific communities have set aside all theoretical and methodological disagreements to come together on a shared position. If most or all members of the relevant thought collective are in agreement, then that collective judgment surely demands a high degree of respect from society generally and the law particularly (1741). In Kevin's case, the point is likely more at the "precaution" stopping point. At this point, rather than deconstruct the fact-finding process or try to press experts toward greater consensus, it makes more sense for the law to assert its fundamental concern for justice when science is weak (Jasanoff, 1745).

In Kevin's case, asserting the law's fundamental concern for justice largely involves protecting vulnerable groups. Therefore, Kevin's case, legal decision-makers might ask: what factors and social conditions render some groups more vulnerable to harm than others? Can those factors be mitigated? In U.S. society, minors are a vulnerable group that warrants additional protection from the legal system. In applying a cascade of deference framework, we might understand that while the science is somewhat stronger in Kevin's case, "consensus" remains elusive. A normative concerns for justice and protection of vulnerability should take precedence over science's claims to authority.

In "Blame," legal scholar David Eagleman thus comes to the conclusion that in Kevin's case, "blameworthiness is the wrong question for our legal system to ask" ("Blame"). But as STS scholars have demonstrated, it is important for the decision-makers in the criminal justice system to challenge the idea that scientific perspectives are uniquely privileged to lay claims to objectivity or truth. This is not to say that neuroscience has no role to play in determining legal responsibility; fMRI and EEG provide us with tools to study the body in exciting and novel ways. But a *serviceable* neuroscience is a neuroscience that allows us to move beyond preconfigured assumptions about technologies as inherently bad or good, beneficial or problematic. Knowledge produced in a neuroscientific lab can and has been interpreted to explain and help understand personality, behavior, and identity in incredibly useful ways. But arguments about advantages and drawbacks in brain sciences must also contend with and account for the complex interactions of "culture, history, researchers, participants, technologies, and rhetoric" (Dumit 2004). As Jasanoff has argued, legal scholars need to recognize that science and law are two arenas that are not "cognitively and culturally distinct" but "engaged in processes of constant exchange and mutual stabilization" (Jasanoff 2004). We need therefore to challenge the process of "purification" embraced by many (the state, scientists, lawyers) that

seeks to separate "scientific," "political," and "social" (Latour 1993). Instead, STS and a serviceable neuroscience must develop situated perspectives that: acknowledge and engage with actors, networks, norms, power, and models of deference; work to capture how knowledge is produced and dispersed in networks and how actors "see" within these networks; are reflexively resistant to denials that truth claims are interpreted; and are themselves subject to critical inquiry.

Contextualizing use is essential to understanding what makes neuroscience "workable" and transferable (or not) across diverse contexts and networks. Neuroimages offer entry points for a serviceable neuroscience to reconfigure lay-expert relations, democratize the practice and deferential prioritization of science, and produce useable and reliable knowledge about how science and society out to interact. In examining neuroscience's foundational assumptions, STS scholars can work to pinpoint important and critical intervention spaces for better engagement that shape law-neuroscience in the public sphere, providing opportunities for deconstructive and reconstructive analysis and offering entry points for neuroscience to contribute to struggles for justice and a better scientific inquiry.

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