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Neuroscience, Neuropolitics and Neuroethics: The Complex Case of Crime, Deception and fMRI

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Abstract Scientific developments take place in a socio-political context but scientists often ignore the ways their innovations will be both interpreted by the media and used by policy makers. In the rush to neuroscientific discovery important questions are overlooked, such as the ways: (1) the brain, environment and behavior are related; (2) biological changes are mediated by social organization; (3) institutional bias in the application of technical procedures ignores race, class and gender dimensions of society; (4) knowledge is used to the advantage of the powerful; and (5) its applications may reinforce existing structures of power that pose ethical questions about distributive justice. The case of crime, deception and functional Magnetic Resonance Imaging (fMRI) shows the complexity, and the political and ethical challenges that confront those who seek to use neuroscience to explain the etiology of crime, and who base policy on its findings. An ethically grounded neuroscience needs to take account of existing structures of power and difference, and to develop a public neuropolitical consciousness that ensures that those subject to risk by the application of science and technology are participants in the decision-making processes involving the implementation of policies that affect them.

Keywords Biosocial theories of crime · Brain and criminal behavior · Criminal justice policy · Deception · fMRI · Neuroethics · Neuroimaging · Neuropolitics · Neuroscience

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Introduction

Rapid advances in neuroscience and its measurement techniques and applications over the last 20 years have led to calls to expand the field of neuroethics, broadly defined as the ethics of conducting neuroscience research and the moral implications of its results and applications; this also increasingly includes consideration of the neuroscience of ethical decision-making (cf. Bird 2005, 2009; Casebeer and Churchland 2003; Churchland 2005; Levy 2007; Roskies 2002, 2006).[1] This emerging field has been charged with engaging the public in ethical discussion "so that future research proceeds in a manner that is sensitive to public hopes and concerns," (Leshner 2005, p. 1) and in order to avoid "mistrust and misunderstanding, which would be a disservice both to the public and to science" (2005, p.2). The challenge, however, is that "science" and "the public" are no more unitary entities than are the mind and the brain:

> no part of the brain is an "island." Individual parts of the brain neither act alone nor appear to be involved in only one function. The interconnectedness of its parts and the multitasking nature of its individual structures means that any intervention… involves potentially great cost-benefit tradeoffs that can go far beyond the specific intent of the intervention (Leshner 2005, p. 1).

Indeed, the neuroscientific revelations of mind–brain–environment complexity, interrelatedness, and mutual causality, and the resultant dangers of myopic intervention, are just as applicable to the implementation of public policy in society. Some neuroscientists (Cacioppo and Visser 2003; Hacking 1995; Keestra 2012) have even referred to the relationship between socio-political factors and neural processes as "reciprocal determinism" suggesting a mutually interrelated "looping" effect "involving both top-down and bottom-up interactions" (Keestra 2012, p. 226).

In spite of this awareness within the neuroscience community about the complexity of these relationships, the politics of conflicting and ideologically shaped interests mediate the outcome of public policies based on scientific research, often with negative impacts on society's most vulnerable groups. Neuroscience and, therefore, neuroethics, are inherently political.

The observation that science does not exist in a vacuum is not new.[2] Science is set in a socio-political context that frames its questions, shapes its funding, and influences its researchers in selecting their topics of study and the theoretical frameworks and methodological techniques employed. Ever since Daniel Greenberg's (1967) classic, *The Politics of Pure Science*, the public has become aware of the way powerful individuals shape public support for privately funded

[1] Since 2008 the field has had its own journal *Neuroethics*. This growth is particularly acute for the use of fMRI in neuroscience. See, for example, the special issue of *The American Journal of Bioethics* in 2005, especially articles by Leshner (2005) and Illes and Racine (2005). As one indicator of this growth Illes and Racine report that research studies using fMRI grew from 15 in 1991 to 2,224 in 2003 or 56 % per year (2005).

[2] See, for example, the work of Bruno Latour and Stephen Woolgar (Latour 1987; Latour and Woolgar 1979).

research. Greenberg exposed the process through which fundable science emerged from a combination of the desire by government agencies to be enveloped in the aura of scientific success, and the badgering of Congressional committees for earmark funding, practices that continue today via university-hired lobbyists (Brainard and Hermes 2008). As John Maddox has insightfully observed: "academic research is everywhere inextricably bound up with the political process if for no other reason than that government subventions must come from government revenues and must be allocated by some mechanism or other" (Maddox 1999, p. xii; Greenberg 1999).

Neuroscience arguably is no less politicized than science in general. If anything, it may be more susceptible to influence because it examines what cannot readily or easily be seen at the intersection of brain/mind/behavior/environment. However the politicization of neuroscience has unfortunately received insufficient critical examination. In his book, *Brain Policy*, Robert Blank (1999, p. 1) argues that while the relationship between brain politics and policy is a critical area for social science and ethics, new developments in neuroscience have largely been ignored by social scientists, even though they have major implications for "human behavior, social institutions and our perceptions of humanhood." Blank calls for an intensified analysis of the advantages and disadvantages of advances in neuroscience, and their social impact (Blank 1999, p. 2). Drawing on sociological insights to inform the neuroethical imagination, Raymond De Vries (2004, 2005) takes up this challenge, providing a broader and richer view of the politics of moral problems. Instead of just mapping brains, "a sociology of neuroscience maps the emerging science, the types and range of ethical questions raised about the science, and the persons, disciplines and institutions who raise those questions" (De Vries 2005, p. 26).

This sociology of neuroscience is especially applicable to studies of neuroimaging since interpreting the meaning of its results is "bound by cultural and anthropological frameworks" (Illes and Racine 2005, p. 6). It is also shaped by the political context in which science is produced.[3] In short, neuroimaging is clearly a political process as well as a scientific one.

The goal of this article is to engage in an interdisciplinary broadening of the conversation about the ethics of neuroscience and neuroimaging. This will be accomplished by addressing a series of overarching themes that are interwoven throughout the article. These include identifying some of the major issues raised by criminologists about neuroscience and their use of neuroimaging; exploring brain-behavior research and the researcher's role in informing crime prevention/criminal justice policy; considering the way criminology has drawn on brain imaging research and what its results say about crime causation; and asking whether crime causation can (or should) be established by neurotechnology, particularly in light of the weakness in the basic research on which its application is based. Indeed, it is the application of poor science that has created some of the difficult ethical, political and legal questions. This is significant because interventions designed to correct

[3] See for example, Henry Greely's article "Prediction, litigation, privacy, and property: Some possible legal and social implications of advances in neuroscience" (2004) for an extensive review of legal issues of neuroscience and neuroimaging.

deviant or offensive behavior often involve cognitive behavioral therapy (CBT) and it is likely that future interventions will be developed based on new understandings of neuroscience (Schermer et al. 2009). As a result, public policy makers not only need to be aware of the ethical issues of applying neuroimaging technology to crime, but also of the science of ethical thinking, moral judgment and ethical decisions. This is because the claimed biological basis for ethical decisions has a tendency to objectify the decision-making process. This objectification, in turn, provides scientific legitimacy to policies that emerge from this process, curtailing ethical considerations and rendering such policies nonpolitical.

Biology, Brain and Criminal Behavior: An Interactive Relationship

A longstanding theme in criminology and criminal justice assumes a causal relationship between biology, in general, and genetics, in particular, and the propensity to commit criminal behavior. In addition to attempts to correlate physical appearance (body type) with crime (Glueck and Glueck 1956); Sheldon et al. 1949), and the more recent claims of a genetic cause of criminality (Ellis 1988; Hurwitz and Christiansen 1983; Jeffery 1994; Martens 2002; Mednick 1985; Mednick et al. 1987; Wilson and Herrnstein 1985), including the now discredited XYY chromosome theory (Jacobs et al. 1965; Telfer et al. 1968),[4] a third dimension of the biological school of thought is the attempt to equate brain activity and brain chemistry with criminal activity. Thus biosocial theory argues that there is an interactive relationship between the embodied human brain and its social/ecological environment that can lead to a greater or lesser propensity to commit criminal behavior. Recently, a more nuanced version of this theory, known as "holistic biology" (Niehoff 2002, p. 30), recognizes an interaction between *everything*, from gene, through cell and organ, to individual physiological, psychological, and social process and socio-structural environment, wherein no one element is the sole determining factor, so that "biology is not destiny" (2002, p. 30).[5] Indeed, as one advocate of this interdisciplinary behavioral science approach states:

> There are no exceptions to the assertion that all complex human behavior is the result of interactions between our genes and our environment. Even behaviors that are predominantly learned alter all future behaviors by modifying the way brain cells function and communicate, producing an essential feedback loop of information exchanged between neurological systems and the environment. This process is not, therefore, static or predestined (Fishbein 2006, p. 48).

The recognition that behavior is the outcome of a reciprocal relationship between the organism and environment over time is a significant advance in criminology that

[4] Ultimately this research showed that the XYY chromosome pattern was more prevalent among prison guards than among prisoners (Sarbin and Miller 1970; Fox 1971).

[5] For an approach that integrates these different levels of crime causation see the work of Robinson and Beaver (2009).

is reflected in the "explanatory pluralism" of some neuroscience (McCauley 2009, 2001; Dale 2008). Indeed, Dale and colleagues state that "explanatory pluralism" is the idea that the universe is sufficiently complex that many theories are necessary to explain it, and that this should be applied to neuroscience because: "the brain–body–environment system is sufficiently rich to admit of levels and goals of analysis that require pluralism to tackle them all" (Dale et al. 2009, p.1).

The Problems of Biologically-Based Criminal Justice Policy

Despite these advances in thinking, however, biological explanations of crime remain a problematic area for most criminologists, not only because criminologists are not typically biologists by training,[6] but because the rush to policy that advocates of biological explanations often embrace is based on correlation rather than causation, and often involves far reaching intrusion into social life.[7] Thus advocates of environment intervention in gene-environment-behavior causality have argued that once the genetic causes or neurological processes have been identified via screening at an early age, aspects of the environment, such as "toxic element concentrations, socioeconomic status, prenatal care, neurological impairments, and learning disabilities," can be "manipulated on a wide-scale basis to prevent the onset of behavioral or forensic disorders in the general population" (Fishbein and Thatcher 1986, p. 258).[8] But, as one commentator who opposes this bio-environmental interventionist policy to crime prevention asks, even if causation rather than correlation could be shown, "Should we be doing skin conductivity tests on toddlers and then locking them up based on the results? Should we give more weight to brainscans compared to upbringing just because you can show the former as a pretty picture?" (Gitlin 2011). From our perspective, it is unethical for crime prevention to create additional harm, especially based on the questionable, rather than certain, state of the science. Even if the science was certain, it is not certain that these policies are the only, or even most effective, ways to reduce the incidence of crime.

Based on a different but related set of assumptions are social interventions that "preserve safety, add structure, and promote attachment to others," such as repairing communities, ensuring the welfare and safety of children, sheltering battered women, supervising recovering substance abusers, and caring for the mentally ill; all reduce violence in the long run (Niehoff 2002, p. 267). These prevention and intervention approaches represent a "general rise of public health strategies of crime control, focusing on the identification of, and

[6] See, for example, *Biosocial theories of crime* by Beaver and Walsh (2010) who argue that most are sociologists without any biological education or training.

[7] An interesting article by Hackman et al. presents findings which "provide a unique opportunity for understanding how environmental factors can lead to individual differences in brain development, and for improving the programs and policies that are designed to alleviate SES[socio-economic status]-related disparities in mental health and academic achievement" (2010, p. 651).

[8] Fishbein (2006) also provides an integrative perspective.

preventive intervention upon, aggressive, risky or monstrous anti-citizens" (Rose 2000, p. 24).[9]

Apart from obvious ethical problems with policies that screen for indicators of problems and/or try to "cure" someone before they have committed a crime/harm, there are logical problems with the causal assumptions informing these theories. First, as noted earlier, most of the biocriminological research establishes correlation, not causation. Recent neurophysiological studies explaining the relationship between brain processes and behavior "have not ruled out the possibility that physical and chemical changes in the brain are the *result* rather than the cause of criminal behavior" (Lanier and Henry 2010, p. 122). Indeed, one of the leading contemporary neuroresearchers, Klaus Miczek, says, "Instead of only looking at biology as the cause of behavior, we also need to consider the reverse—that being the aggressor or victim of aggression is the event that sets the neurobiological processes in motion" (cited in Niehoff 2002, p. 116).

A second problem with research on the biology-crime connection is that the knowledge available about crimes is largely based on studies of the behaviors of arrested or convicted offenders. However, criminological victimization survey data show that, at best, only 33 % of all criminals convicted are known to the police.[10] So the correlational brain data show more about the profile of arrested/convicted offenders than about the majority of those who are likely to commit an offense. Because it cannot be assumed that the arrested/convicted offenders are representative of those who are not arrested, policies based on the analysis of the crimes of convicted offenders, and their biological or specific genetic predispositions, are of questionable value in preventing crime.

A third problem with this research is that it is largely focused on street crimes or conventional crimes rather than crimes by white collar offenders. In particular, it ignores any collective crimes such as those by corporations, boards of directors, state agencies or dysfunctional organizations on their victims. In other words, conventional anti-crime policy based on biological assumptions typically uses a simplistic and unproblematic definition of crime, rather than recognizing that this is a complex multi-faceted category comprised of varieties of behaviors, each with different causes, even for the same crime (Henry and Lanier 2001).

These unsettled issues then, are compounded, as shown below, when considering policies that emerge from recent developments that measure brain activity as an indicator/marker for (rather than cause of) crime. Compounding these problems are the methods used to establish the way that the brain's structure and function operate in the brain–environment-behavior nexus, particularly those structures and functions identified and implicated in brain imaging techniques.

[9] While neuroscientists generally recognize the difficulty of designing experiments to target those cognitive aspects with correlated brain areas, this does not seem to extend to criminologists advocating policy based on their research.

[10] This is established from victimization surveys of the general population. The reported rate of crime victimization is found to vary by offense and is higher when injury or high value property is involved such as auto theft (92 % reported), compared with robbery (61 % reported), burglary (45 % reported), or low value personal larceny (15 % reported) (Lanier and Henry 2004).

Images of the Brain in Crime Causation

In spite of these difficulties, some criminologists, most notably Adrian Raine, have established a research agenda devoted to exploring the linkage between brain activity and criminal behavior and in particular, the effects of brain structure and function on criminal and anti-social behavior (Raine 2002; Raine et al. 1997, 1998, 2000). He and his colleagues have used a variety of brain-imaging techniques to explore whether a particular variation in brain structure or function correlates with severe violence. For example, Raine and colleagues (1997) used PET scans to analyze the brains of murderers and controls. The analysis found both functional and structural differences in the brains of the convicted murderers compared to controls, in both the prefrontal cortex and the amygdala. In another PET-scan study, Raine and colleagues (1998) classified murderers into premeditated or "instrumental" murderers and impulsive or "expressive" murderers, compared to controls, and found differences in the prefrontal cortex. In other research, they also studied the volume of the brain in the prefrontal cortex and found that there was a difference between psychopaths and controls, with the former having less brain volume in the prefrontal cortex than the latter (Raine et al. 2000). As Kevin Beaver and Anthony Walsh state, "Together, the results of these studies provide solid evidence indicating that various regions of the brain—especially the prefrontal cortex—are associated with a range of antisocial phenotypes" (2010, p. xxiii).

However, there is no way of knowing whether those charged with murder[11] are a representative sample of all murderers, as they only represent those caught and charged with this offense. Also, in these studies in particular, the subjects were referred to the testing center for a variety of psychiatric conditions and their referral was intended to establish evidence for a possible "not guilty by reason of insanity" (NGRI) defence.[12] Thus, the characteristics of the brain revealed in the studies may have more to do with their mental illness/brain condition than with the reasons why people commit homicides or manslaughters. In order to know that, one would have to know whether the rate of arrests for homicide is higher among those with similar brain conditions who did not commit such offenses, than the rates of homicide for those without these conditions relative to the general population. Further, although not convicted, all subjects were in custody during the study period, so the results may be more about the characteristics of who gets arrested, charged and held in custody than about the functioning and structure of the brains of those in the population who commit murder. In order to establish the relationship between extreme violence and brain structure and function, one would need to compare unconvicted, active murderers with the brains of controls.[13] It would also be

[11] The studies referred to here are based on a sample of 41, 39 men and 2 women (Raine et al. 1997).

[12] The reasons for referral included: "schizophrenia (6 cases), history of head injury or organic brain damage (23), history of psychoactive substance abuse (3), affective disorder (2), epilepsy (2), history of hyperactivity and learning disability (3), and passive aggressive or paranoid personality disorder (2)" (Raine et al. 1997, p. 496).

[13] While this would be difficult research to conduct, it might be possible to look at the neuropsychology of those convicted of murder, and then found to be innocent, although that adds the complication of the effects of imprisonment on their brain functioning.

informative to compare the brain functions of charged offenders who have psychiatric institutionalization histories with convicted offenders, and also compare offenders who have served different lengths of sentence/institutionalization, as well as those who have served the same amounts of time for different offenses. This would enable criminologists to disaggregate the effects of institutionalization/prisonization[14] on the brain, rather than assuming that the behavior for which they were convicted was the result of their brain abnormality. Yet another valuable study to more accurately establish whether there is a relationship between brain structure and/or function and criminal behavior, would be to compare the brain function of charged and convicted murderers with members of the military who have killed in combat in order to determine if there are changes in brain structure and function over time in both populations as a result of their killing behavior, rather than preceding it. Indeed, some research has suggested that social context, position and behavior can change brain biology and particularly brain chemistry and the production of dopamine and serotonin (Niehoff 2002; Raleigh et al. 1980; Van Erp and Miczek 1996). Clearly, the issue of the relationship between brain, environment and behavior is more complex than the existing brain imaging studies can reveal. These problems are further compounded when one looks at fMRI (functional Magnetic Resonance Imaging) as the technique of neuroimaging.

Imaging the Brain for Truth/Lie Detection: fMRI, Private Companies and the Media

The first question with fMRI is whether measuring activity in the brain makes it possible to "see," in any meaningful sense, the genesis of crime, deviance or deception, or whether people are lying about their participation in such activity.

This functional MRI detection of lies is based on the measurement of blood flow in the brain and rests on a series of questionable theoretical assumptions. Fundamental among these assumptions is that: (1) blood flow in the brain corresponds to brain activity; (2) certain areas of the brain are more active when lies are being formed than are other areas (lies take more brainwork); and (3) certain areas of the brain are responsible for different functions. During deception the anterior cingulate cortex, which controls the brain's monitoring of errors, is more active; the dorsal lateral prefrontal cortex, which controls behavior, is more active; and the parietal cortex that processes sensory input is more active (Langleben et al. 2006; Mohamed et al. 2006). As psychiatrist Daniel Langleben and his colleagues state:

> The key conclusion from the initial studies was that the cognitive differences between deception and truth have neurophysiological correlates detectable by fMRI. Subsequent series of studies confirmed the involvement of the medial anterior prefrontal cortex and the bilateral inferior lateral and superior parietal gyri in deception. These studies demonstrated that the effect previously observed at a group level, could be detected in single subjects and even single

[14] This is the process of being socialized into prison life and culture and how this affects subsequent relationships once released.

> events of lying. Moreover, the fact that the activation related to truth-telling tends to locate posterior to the activity during lie, supports the prediction, that deception is a more complex and working memory-intensive task than truth. The implication of these observations is that a response could be classified as lie by the pattern of brain activity it produced, regardless of whether it is objectively true or false (Langleben et al. 2006, p. 360),

Each of these areas, the anterior cingulated cortex, the dorsal lateral prefrontal cortex, and the parietal cortex shows more oxygenated blood flow. According to Langleben, these areas show higher oxygenated blood flow since they are working harder, and he believes they do so because first "your brain has to think of the truth and then make a decision, in a sense, to do the opposite" (Temple-Raston 2007).

In recent years, the mass media[15] have focused on the commercialization of this technology, and in particular on a San Diego company called "No Lie MRI" founded by Joel Huizenga, that claims to have developed a 90 % success rate for lie detection based on a study of 22 students (No Lie MRI 2006). This company claimed a detection rate better than the polygraph test, which is notoriously unreliable and has historically been ruled inadmissible as evidence in court trials since 1923; although in 1993 the standard was changed in the case of *Daubert v. Merrell Dow Pharmaceuticals* (1993), and by 2007 it was admitted as evidence in 19 states, although the accused cannot be forced to take the test. "No Lie MRI" offers the lie detection or truth verification service based on fMRI brain scans and using software and computer analysis that claims to show whether someone is lying.

A variant of fMRI has been developed by Massachusetts-based Cephos Corp derived from research conducted at the Medical University of South Carolina by Frank Andrew Kozel. Cephos' website claims to "have coauthored and presented numerous scientific publications and abstracts, …tested over 300 people, and tested diverse populations" and that "clinical testing has shown accuracy rates between 80 and 96 %" (Cephos Corp 2008). While Huizenga's No Lie MRI is marketing to corporations and individuals, essentially for exoneration of accusations, and particularly for people who want to prove their fidelity to a spouse, Cephos' stated goal "is to develop accurate tools to detect deception that are automated, non-human based, testable, published in scientific journals, and have the greatest chances for court admissibility" (Cephos Corp 2008). Indeed, in spite of a lack of adequate clinical trials, the cost of administering the process, and the vulnerability of fMRI to deliberate manipulation, commentators have imagined how the tests would be used in crime prevention and detection procedures. The following observation is illustrative:

> Imagine if the FBI or the CIA had a test that could say definitively if someone were lying. Imagine not just how that could help uncover spies – the polygraph is still in use to do that — but also how it could be used with terrorists and

[15] This story has been covered by *USA Today* (Willing 2006), *NPR* (Temple-Raston 2007), *San Francisco Chronicle* (Haddock 2006), *Newsweek* (Begley 2008), and *The New Yorker* (Talbot 2010), among others.

> common criminals. Why would you need coercive interrogation techniques if you could watch a lie forming in the brain?… And public use is the next natural step. But so far, the studies have been limited. The functional MRI has largely been used on undergraduates in research settings. It hasn't been tested on criminals, con men or good poker players, so it is unclear whether the technology would work on everyone and, more fundamentally, whether it is the lie detector everyone is waiting for (Temple-Raston 2007).

Those considering applied neuroscience have raised similar ethical concerns:

> Maybe we want to subject potential terrorists to fMRI scans, to see, for example, excited activity in the amygdala, perhaps signaling anger. Or maybe we want to subject known terrorists to fMRI-enabled polygraph tests (sic), thinking these more reliable than traditional means and therefore expedient in our intelligence gathering (Allhoff 2011, p. 15).

The answer to whether society should engage in this practice depends, as Fritz Allhoff says, in part on whether neuroscience can demonstrate the effectiveness of the technique. So far, such results have been elusive.

The Limits of fMRI for Crime and Public Policy

Critics such as David Heeger have argued that public use of fMRI technology should not take place until more research is conducted and, in particular, until it is established "whether a false or imagined memory will show up as a true response or a lie" (cited by Willing 2006).[16] This is important since it gets at a fundamental question in criminology around the issue of what constitutes crime (Henry and Lanier 2001). With common "street crimes" such as assault, burglary, robbery, theft, rape, arson or homicide, it is possible to see where suspects could be exonerated or found to be lying based on fMRI testing, assuming that this evidence were to become admissible in court,[17] and assuming that methods could be found to increase the reliability of the testing process, and reduce its susceptibility to sabotage by reluctant suspects. However, so far the research subjects have been very unrepresentative of those involved in criminal activity; as Margaret Talbot has pointed out:

> Among the problems with using fMRI for lie detection, for instance, is the fact that the studies demonstrating its efficacy are based on lies about trivial matters—say, what playing card you've been shown— elicited in laboratory situations, in which mostly healthy, young, non-criminal subjects are instructed to lie. There are no fMRI studies of high-stakes lying, or lying by

[16] See also the work of Robinson (2010). A critical and balanced discussion is provided by Wolpe et al. (2005).

[17] fMRI currently has not been admitted as evidence since the evidence for research of its effectiveness has to be accepted by the scientific community and so far it has been ruled not to meet the Daubert standard; see the Lorne Semrau fraud case in which the court threw out the fMRI evidence in spite of expert testimony from Steven Laken, the C.E.O. of Cephos and researcher Andrew Kozel. For a summary see *Discover Magazine* (2010).

practiced liars, or even by people who are practiced in the one particular lie relevant to the case (Talbot 2010).

Even with these kinds of conventional crimes it has been pointed out by Stephen Kosslyn that rehearsed lies of seasoned criminals might activate different parts of the brain (Haddock 2006), and may in fact require no extra oxygenated blood; rather, extra brain activity might be required if the professional criminal were to tell the truth.[18]

This raises an additional complication of fMRI because neuroimaging research has been restricted to certain unrepresentative populations. Indeed, Jeffrey Arnett (2008) and Joseph Henrich and colleagues (2010) have pointed out that since most studies in the behavioral sciences have been conducted using Western psychology students who are found to be unrepresentative of other populations, particularly those from other global cultures, bias may render these results meaningless when applied to such populations.[19] Regardless of whether actual conventional crime rates are similar or different for different races, ethnicities and cultures, non-Caucasian and ethnic minorities are over-represented in the prison population.[20] Such culturally biased behavioral research is, therefore, of questionable applicability to the very populations about whom fMRI deception research is drawing conclusions.

Indeed, the problem is further compounded with white-collar crimes,[21] particularly crimes by corporations, because their offences are often committed via a taken-for-granted process in which no single person is culpable, even though the collective outcome is both profitable for the company and harmful to its customers, investors and/or employees.[22]

[18] While it is possible that deception can produce different patterns of brain activity than simply showing an increase in one or more areas compared to truth telling, the evidence so far (Langleben et al. 2006; Mohamed et al. 2006) suggests only an increase in brain activity in certain areas is correlated with deception. So the potential for deception being associated with a decrease in some areas and an increase in others, makes it less easy to distinguish from truth telling. The same variable pattern would also be likely in truth tellers. Indeed, as indicated, those who genuinely believe in the truth of their deception would likely be indistinguishable from truth tellers, regardless of whether the deceivers' brain activity went up in some areas and down in others.

[19] Arnett (2008) and Henrich et al. (2010) have demonstrated evidence of socio-cultural bias in behavioral and brain sciences.

[20] The U.S. population as of 2010 comprised 16.3 % Hispanic, 12.6 % African American (US Census Bureau 2011). In contrast African Americans accounted for 39.4 % of the prison and jail population in 2009 and Hispanics accounted for 15.9 % of all those incarcerated (Bureau of Justice Statistics 2010). These data indicate that African Americans are disproportionately represented in the criminal justice system.

[21] White collar offenders may be more representative of the subjects in the fMRI studies.

[22] In fact, "No Lie MRI" is pitched toward corporate interests by suggesting that subjecting financial officers and Chief-Executive-Officers to testing in making earnings statements would improve investor trust, lower a company's risk and increase its value: "Investors discount future cash flows, resulting in lower perceived net present values of possible investments due to the potential of deception from unverifiable claims made by corporate officers of potential investment. These corporate officers could receive higher valuation of the potential investment by lowering the risk to the potential investors. No lie MRI increases value by reducing risk through mental verification." (No Lie MRI 2006). Similarly, the detection technology is also pitched at employers to improve employee dishonesty and fraud through effective honesty and drug use screening, arguing that there is no law against this practice, unlike the use of lie detector tests.

Moreover, research on the effectiveness of fMRI by Kozel and colleagues (2009)[23] who conducted a study of 36 participants, concluded "fMRI presently can be used to detect deception concerning past events with high sensitivity, but low specificity" (2009, p. 220). For the 9 participants who were asked to participate in a mock crime and then lie about it, deception was predicted; however, only 5 of the 15 participants who did not participate in crime (33 %) but who had constructed a false alibi were detected. In addition the authors state that their study,

> did not equal the level of jeopardy that exists in real-world testing. The reality of a research setting involves balancing ethical concerns, the need to know accurately the participant's truth and deception, and producing realistic scenarios that have adequate jeopardy. In addition, this study only involved healthy adults who were not taking any medications. Thus, whether fMRI deception testing would work is unknown for participants who are taking a medication, who have a significant psychiatric or medical condition, or who are outside the 18–50 year age range (Kozel et al. 2009, p. 228).

Others who have reviewed the effectiveness of fMRI in deception detection have stated that the image of the brain lighting up in such studies is replicated only 50 % of the time for the same task, so test–retest reliability is low and "results from fMRI research may be somewhat less reliable than many researchers implicitly believe" (Bennett and Miller 2010, p. 150). Neuroscientist Alan Leshner (2005, p. 1) has cautioned "we need to be absolutely confident about the reliability and validity of our brain measurement technologies…before we allow them to be used freely in legal and judicial settings. Moreover, Judy Illes and Eric Racine state, "responsible and careful interpretation of data will therefore become a crucial issue as we wrestle to untangle what we image from what we imagine" (2005, p. 12). They remind policy makers and practitioners that "in the past, various models of the brain have been proposed by great minds only to be seen later as mere imagination of the brain's real functioning" (2005, p. 13). Based on the present evidence, confidence in reliability and validity is not found and imagination exceeds the images.

The conception of fMRI in crime prevention and detection is one based on a simplistic model of lies, deception, and cheating, and a crude definition of crime and deviance. It also glosses over cultural differences in what and how it is appropriate to communicate to others and to which others information might be communicated. What difference would cultural differences make for lying, deception, and their neural correlates as revealed through fMRI? At present it is not possible to know.

Informing this simplistic conception is a long-standing assumption that technology can be used to discover the secret criminal/liar/addict/cheat embodied in those about whom society has moral questions, and to make judgments about their moral worth. Unfortunately, the history of these assumptions reveals how they have often led to policies that target the "other"—women, minorities, the disenfranchised and marginal. Such attempts have resulted in the use of ethically questionable techniques, practices and in some cases actual policies such as eugenics, lobotomies, involuntary commitment, and segregation.

[23] The authors included Steven Laken of Cephos whose corporation also helped to fund the study.

At its best, fMRI is likely to be both ineffective and meaningless, as recently pointed out by Daniel Carlat, who has written extensively about ethical issues in the practice of psychiatry. Carlat (2008) underwent the lie-detection process of the fMRI test (through Cephos) as part of his research for an article about neuroimaging and brain scans: “The next day [after the fMRI test], I’m back at my office. I see my patients, listen to their troubles, try to understand what drives their suffering, and prescribe my nostrums. I deal in brain trouble, and meaningful pictures of what is going on behind their pained expressions would aid my work immeasurably. After my last patient, I pull out [the] snapshots of my own brain. My journey through the land of functional neuroimaging had helped me to understand how spectacularly meaningless these images are likely to be” (Carlat 2008). Whether there will be a role for such images in the future remains in the realm of possibility. At present the premature application and marketing of this technology, as a valuable scientific tool to understand the mind and behavior, needs considerable caution and critical appraisal as part of an exploratory public debate about the ethics of new developments in science and technology.

Toward an Ethically Grounded Neuroscience of Morality

The complexity of the ethical issues involving applied neuroscience is substantial. This stems in part from the implications of the observations by neuroethicists who have argued that neuroethics is faced with a double task (Roskies 2002). First are the ethical implications of the application of neuroscience and neurotechnology, such as the fMRI example we have been discussing in relation to crime and deception. This “ethics of neuroscience” focuses on the ethics of how neuroscience is conducted, including the ethics of employing weakly substantiated techniques in legal and political processes that can have a major impact on people’s lives, and the ethical implications of the results of neuroscientific studies that affect a wide range of social, political and legal institutions and policies. Neal Aggarwal (2009, p. 240) has concisely summarized the ethical issues relating to applying neuroimaging in the courts:

> First, the neuroimaging technology in its present state is poorly understood. Second, functional neuroimaging as an instrument cannot properly measure sociolegal values such as intentionality. Third, functional neuroimaging may subvert theories of individual agency with major consequences (Aggarwal 2009, p. 240).

As to the first point, not only is neuroimaging affected by physical movement of the subject, and by substances he or she may have taken prior to the imaging, but “the possible clinical significance of demographics such as age, race, and sex on results also remains unknown” (Aggarwal 2009, p. 240; Illes 2005). The issue of the inability to measure intentionality becomes critical, not only because to convict a defendant in law he or she must be shown to have been consciously aware of the act and its consequences (*mens rea*), but also because in cases, such as corporate crime, intent is fragmented across different persons at different levels of the organization, such that no one individual has, or needs to have, intent for the overall crime, even though harm is the outcome of their combined collective set of actions. How then is it possible to neuroimage the fragmented collective brain/mind? What are the ethical implications of holding individuals—but not fragmented collectives—responsible for crimes? How are individuals responsible if they were only responsible for one element of a process, the overall results of which they neither determine nor control?

Aggarwal's last issue, the notion of whether neuroimaging subverts theories of human agency, is part of the wider discussion constituting Adina Roskies' second task of neuroethics: the role of cognition in moral decision-making, or the "neuroscience of ethics." Here the concern is with the many things that can change when viewed through the lens of neuroscience: what is ethical; how individuals make moral decisions; the sense of identity; how and whether free will exists; and "the very fabric of our philosophical outlook on life" (Roskies 2002, p. 22; Aggarwal 2009). An important subset of this issue is the ethics of how the brain can be affected to produce such changes in behavior, and particularly, changes in ethical behavior.

Unquestionably, the development of science and technology can have enormous practical value in the advancement of civil society. However, as discussed in the fMRI example, and as the history of applying science to criminal justice policy bears witness, when science and politics (and business) come together, and policy makers see these developments as technological fixes to intractable and complex social problems, the potential for causing great harm can be obscured.

As a result of these concerns several academics, including Henry Greely, have called for an open debate on the topic (Greely 2004; Haddock 2006).[24] Gregg Bloche has called for scientists, lawyers and ethicists to conduct a "high profile discussion" of this technology's "potential uses and pitfalls before it is made available to the public" (Willing 2006). As a contribution toward this discussion we argue that an ethically grounded neuroscience needs to take account of existing structures of power and difference, to be cautious of science's legitimating and sanitizing potential, or what Greely calls "the sexiness of science,"[25] and to develop a neuropolitical consciousness. This is especially important in matters dealing with public policy, where state power is being used to control or harm members of society as retribution or "just desserts" for offenses they have been found to commit, particularly if the "finding" is based on such unproved technology. An ethically grounded neuroscience needs to consider institutional bias in the application of technical procedures and crime control in the name of "public health interventions" that historically have simultaneously ignored race/ethnicity, class and gender dimensions of society, and to consider the ways that knowledge is used to the advantage of the powerful. Policy makers and practitioners need to be

[24] In addition, Greely and Illes (2007) call for regulations restricting use of neuroimaging lie detection technology outside of the research setting until it has proven to be safe and effective.

[25] Research has shown that "neuroscientific evidence has an unusual persuasive power… that inspires a level of trust that is not warranted by the actual data behind it" (Robinson 2010) and that this effect is more persuasive on those least informed about the science (McCabe and Castel 2008; Robinson 2010; Weisberg et al. 2008).

aware of how the application of neuroscientific technologies may reinforce existing structures of power, and not be blinded to the ways that these processes may disproportionately impact the relatively powerless. Illes and Racine (2005, p. 10) ask about discrimination and stigma: "How will such technology be used advantageously to benefit people and society? Could it be used harmfully for ill-intentioned purposes… for triaging team players or weak decision makers in the workplace… or in this post-Columbine era, at the door of our high schools to triage out students with a predisposition to unruly or violent behavior?" While recognizing the positive impact, they also identify the negatives "such as the potential for personal and legal discrimination, inequities of access, risks to confidentiality, inaccuracies inherent to predictive testing of any nature… and commercial use" (Illes and Racine 2005, p. 12).

Is there also a case for considering how the neuroscience of ethics interrelates with the neuroprocesses involved in crime? So far, much of the debate about neuroimaging has been concerned with researching whether neuroimaging can detect lies and deception. Less discussed has been evidence about the neuroscience of deception. What brain processes occur to produce offenders, particularly corporate and white-collar offenders, who ethically and morally justify their harm producing activities and, in some instances, believe they are making positive contributions to society? How does the neuroscience of ethics explain these kinds of ethical contradictions? How does one differentiate "ethically" perceived lies and deception from unethically perceived lies and deception? At what point in the process of what criminologists call neutralization techniques—words and phrases that negate morality by excusing or justifying offensive behavior (Matza 1964; Sykes and Matza 1957)[26] –do the neurological processes that remove the perception of guilt, and the awareness of lying, become a part of the motivation for crime? In short, an ethically grounded neuroscience needs to explore how the very cognitive processes that create a moral community are also those that can undermine it, while being the least available for detection through the systems that can measure them. Thus the neuroscience of ethics becomes a window to the neuroscience of crime; not of measuring whether, or not, someone is lying but of tracking the cognitive development of multiple conflicting moralities and their implications for crime and society.[27] Such an approach would move the discussion from the myopic search for detecting lies and deception to policies that better address how to prevent harms from occurring in the first place. A neuroscientific foundation for such policies would move society from the limited rational and situation choice models of crime causation, in which punishment is supposed to increase the cost and reduce the rewards, or rehabilitation and treatment to correct emotional, behavioral and social deficits, toward deepening understanding of the ways biological processes

[26] For an overview of neutralization theory see "Excuses, excuses: What have we learned from five decades of neutralization research?" by Maruna and Copes (2004).

[27] This relates to the wider debate in neuroscience about how long-standing cultural values and practices can shape and structure neural processes, including those involved in moral decision making, "perhaps leading not just to functional differences but to truly constitutional brain differences between cultures" (Keestra 2012, p. 238), groups, and subgroups. See also Park and Huang (2010); Han and Northoff (2008).

interrelate with social and political processes over time to produce different kinds of outcomes, requiring different kinds of interventions than those currently available in the criminal justice toolbox.

Finally, when incorporating cutting-edge science and technology into public policy, regardless of the level of sophistication of its analysis or the veracity of its findings, it is worth considering whether those subject to risk by its application are themselves included as participants in the decision-making processes involving the implementation of policies that affect them. This avoids the problem of inflicting policies with potentially harmful effects (incarceration, probation, fines, treatment) on those relatively powerless to resist those effects, while allowing those with better resources and social capital to escape the same consequences. Without public debate about the possible policy implications of this kind of neuroscience technology, there is a real danger that technology will substitute for policy. But without a sophisticated understanding of who constitutes the public, how different groups are differently affected by neuroscientific developments and their applications, and without an awareness that scientists in the public debate may not be of the same politics or interests as scientists applying research as policy, then there is the danger of a fragmented approach to neuroscience and technology. In short, what is needed is comprehensive, inclusive, holistic neuropolitical awareness that traces the plurality of neuroethics over time and comparatively assesses how its multiple emerging moralities are different for different groups and subgroups, and will, as a result, require different forms of intervention. Such conversations about what constitutes a public neuropolitical consciousness are necessary precursors to developing effective and ethical public policy.

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