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REVIEW PAPER

# Neuroprediction, Violence, and the Law: Setting the Stage

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**Abstract** In this paper, our goal is to (a) survey some of the legal contexts within which violence risk assessment already plays a prominent role, (b) explore whether developments in neuroscience could potentially be used to improve our ability to predict violence, and (c) discuss whether neuropredictive models of violence create any unique legal or moral problems above and beyond the well worn problems already associated with prediction more generally. In "Violence Risk Assessment and the Law", we briefly examine the role currently played by predictions of violence in three high stakes legal contexts: capital

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sentencing ("Violence Risk Assessment and Capital Sentencing"), civil commitment hearings ("Violence Risk Assessment and Civil Commitment"), and "sexual predator" statutes ("Violence Risk Assessment and Sexual Predator Statutes"). In "Clinical vs. Actuarial Violence Risk Assessment", we briefly examine the distinction between traditional clinical methods of predicting violence and more recently developed actuarial methods, exemplified by the Classification of Violence Risk (COVR) software created by John Monahan and colleagues as part of the MacArthur Study of Mental Disorder and Violence [1]. In "The Neural Correlates of Psychopathy", we explore what neuroscience currently tells us about the neural correlates of violence, using the recent neuroscientific research on psychopathy as our focus. We also discuss some recent advances in both data collection ("Cutting-Edge Data Collection: Genetically Informed Neuroimaging") and data analysis ("Cutting-Edge Data Analysis: Pattern Classification") that we believe will play an important role when it comes to future neuroscientific research on violence. In "The Potential Promise of Neuroprediction", we discuss whether neuroscience could potentially be used to improve our ability to predict future violence. Finally, in "The Potential Perils of Neuroprediction", we explore some potential evidentiary ("Evidentiary Issues"), constitutional ("Constitutional Issues"), and moral ("Moral Issues") issues that may arise in the context of the neuroprediction of violence.

**Keywords** Neuroscience · Prediction · Criminal law · Psychopathy · Violence risk assessment

> "It is, of course, not easy to predict future behavior. The fact that such a determination is difficult, however, does not mean that it cannot be made. Indeed, prediction of future criminal conduct is an essential element in many of the decisions rendered throughout our criminal justice system."
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> – *Jurek v. Texas,* 428 U.S. 262 (1976).

## Introduction

In order for legal sanctions to work effectively, they must be based on sound predictions concerning the complex relationship between people's motives, aversions, intentions, and actions. We create and enforce laws not only in order to give offenders what they deserve but also in the hope that doing so makes it less likely that people will engage in activities that tear at the moral fabric of society. Unfortunately, despite our best efforts to wield the power of the law to shape and mold human behavior, unlawful acts of violence and aggression still occur far too frequently. Given the emotional, moral, and financial costs of violent behavior, it is unsurprising that preventing violence is one of the most important goals of our legal system. Attempts at prevention are more likely to succeed when they are based on accurate predictions of who will engage in violence and under what circumstances. However, our ability to accurately identify individuals who pose a future threat to society has been very limited until recently. Indeed, predictions of violent recidivism were so inaccurate just 35 years ago that a task force of the American Psychological Association officially concluded, "psychologists are not competent to make such judgments" (1974, p. 1110).

Fortunately, the field of violence risk assessment has made progress in the past two decades. Researchers are slowly piecing together a more accurate picture of the biological and situational roots of violent behavior. In light of these advances, our ability to accurately predict violence has increased considerably. Admittedly, we still have a long way to go before we should feel comfortable with the role that violence risk assessment plays in the law, since errors on this front are both morally unacceptable and economically costly. Thus, the prediction of violence is a pressing moral and legal problem as well as an empirical challenge. As we continue to make progress on the empirical front, we need to ensure that these advances don't create any moral or legal costs we are unwilling to accept.

That being said, we are not going to take a stand in this paper on the normative issue concerning whether and when violence risk assessment should be used in the legal system. Nor are we going to take a stand when it comes to the moral appropriateness of some of the controversial legal contexts within which violence risk assessment presently plays a prominent role—e.g., executing offenders who commit capital crimes or detaining sexual predators after they have already served out their criminal sentences. Regardless of what one thinks of the legal relevance of predictions of violence more generally or the moral

status of the legal contexts within which these predictions are used, violence risk assessment is likely to continue to play a prominent role in various parts of the law in the foreseeable future. As such, so long as newly developed methods for predicting violence provide legal decision makers with more powerful predictive tools without thereby generating any additional moral or legal concerns, we believe that all parties to the debate about the potential uses and abuses of predictions of future dangerousness should want to ensure that the predictions that are used for the purposes of the law are as valid and reliable as possible. Rather than trying to settle the empirical, moral, and legal issues that arise in the context of predictions of future dangerousness, our present goal is to (a) survey some of the legal contexts within which violence risk assessment already plays a prominent role, (b) explore whether developments in neuroscience could potentially be used to improve our ability to predict violence, and (c) discuss whether neuropredictive models of violence create any unique legal or moral problems above and beyond the well worn problems already associated with prediction more generally.

In "Violence Risk Assessment and the Law", we briefly examine the role currently played by predictions of violence in three high stakes legal contexts: capital sentencing ("Violence Risk Assessment and Capital Sentencing"), civil commitment hearings ("Violence Risk Assessment and Civil Commitment"), and "sexual predator" statutes ("Violence Risk Assessment and Sexual Predator Statutes"). In "Clinical vs. Actuarial Violence Risk Assessment", we briefly examine the distinction between traditional clinical methods of predicting violence and more recently developed actuarial methods, exemplified by the Classification of Violence Risk (COVR) software created by John Monahan and colleagues as part of the MacArthur Study of Mental Disorder and Violence [1]. In "The Neural Correlates of Psychopathy", we explore what neuroscience currently tells us about the neural correlates of violence, using the recent neuroscientific research on psychopathy as our focus. We also discuss some recent advances in both data collection ("Cutting-Edge Data Collection: Genetically Informed Neuroimaging") and data analysis ("Cutting-Edge Data Analysis: Pattern Classification") that we believe will play an important role when it comes to future neuroscientific research on violence. In "The Potential Promise of Neuroprediction", we discuss whether neuroscience could potentially be used to improve our ability to predict future violence. Finally, in "The Potential Perils of Neuroprediction", we explore some potential evidentiary ("Evidentiary Issues"), constitutional ("Constitutional Issues"), and moral ("Moral Issues") issues that may arise in the context of the neuroprediction of violence.

## Violence Risk Assessment and the Law

One of the central goals of the law has always been to make society safe by preventing violent behavior.[1] This goal is more likely to be achieved if law makers and enforcers can accurately identify violent individuals and predict their future behavior. As a result, although violence risk assessment has traditionally not played any role in determinations of guilt, it has played a role at nearly every other stage of the criminal law—from decisions concerning whether to grant bail to decisions concerning whether to grant parole.[2] Trying to explore all of these contexts would take us too far afield. So, for present purposes, we are going to limit our attention to three legal contexts in which predictions of violence are commonplace: (a) capital sentencing; (b) civil commitment hearings; and (c) post-imprisonment detention hearings for so-called "sexual predators." These contexts are worthy of attention both because they involve very high stakes—ranging from liberty to life—and also because predictions of future violence already play a prominent role in these contexts. Hence, they seem to be precisely the kinds of legal domains where neuroprediction could likely be used.

### Violence Risk Assessment and Capital Sentencing

Capital sentencing is one controversial context where violence risk assessment is often used by judges and juries to make grave decisions concerning life and

[1] For the purposes of this essay, we are following Megargee [3] in using the terms "violent behavior" and "violence" to apply to acts such as "homicide, mayhem, aggravated assault, forcible rape, battery, robbery, arson, extortion" and other criminal acts that cause physical injuries.

[2] See [4] and [5] for attempts to identify all of the wide variety of legal contexts that depend, at least in part, on predictions of future violent behavior.

death.[3] For instance, two states—Texas and Oregon—explicitly require jurors in capital cases to consider evidence concerning future dangerousness. Twenty-one states consider a defendant's future dangerousness to be an aggravating circumstance at the sentencing phase of capital trials, though they do not make future dangerousness a necessary condition for the death penalty. Still, some states, such as California, Mississippi, and Pennsylvania, do not include future dangerousness as an aggravating circumstance for the purposes of capital sentencing. Indeed, in *People v. Murtishaw*[4] the Supreme Court of California determined that because clinical predictions of future dangerousness are highly unreliable, prejudicial, and of limited relevance, admitting these predictions in the context of capital sentencing is a reversible error.

The admissibility of clinical predictions of violence during capital sentencing was one of the key issues before the United States Supreme Court in *Barefoot v. Estelle*.[5] Thomas Barefoot had been convicted of murdering a police officer. During the sentencing phase of the trial, the prosecution called two psychiatrists—Dr. John Holbrook and Dr. James Grigson[6]—to testify about the future dangerousness of the defendant. Neither doctor had ever actually met or interviewed Barefoot. Instead, they based their judgments on a lengthy hypothetical scenario that was predicated on the following four assumptions: (a) that the defendant had a reputation for disobeying laws in the community; (b) that the defendant had previously escaped from jail; (c) that the defendant was responsible for committing four previous non-violent offenses; and (d) that the defendant was responsible for murdering a police officer. In response to the hypothetical scenario, Dr. Holbrook concluded that Barefoot was a "criminal sociopath"[7] and that in his professional opinion, there was a "reasonable psychiatric certainty" that Barefoot would "commit criminal acts of violence in the future that would constitute a continuing threat to society."[8] Dr. Grigson went even further in claiming that, "whether [the defendant] was in society at large, or in a prison society there was a '*one hundred percent and absolute*' chance that [the defendant] would commit future acts of criminal violence that would constitute a continuing threat to society."[9]

During the sentencing phase of the trial, the jury was instructed to determine whether there was "a probability that the defendant would commit criminal acts of violence that would constitute a continuing threat to society."[10] The jury found that there was indeed a probability that Barefoot would pose a continued threat. Furthermore, because the jury also determined that each of the other two criteria for the death penalty had been met,[11] the judge subsequently sentenced Barefoot to death as was mandated by the Texas statutory scheme that had earlier been reviewed by the United States Supreme Court in *Jurek v. Texas*.[12]

On appeal, Barefoot raised several questions concerning the role that clinical predictions of future dangerousness played during the sentencing phase of his trial. First, he claimed that the term "probability" was too vague and should have been more clearly defined in the jury instructions. Second, Barefoot claimed that the testimony by Dr. Holbrook and Dr. Grigson should not have been heard by the jury since (a) the two psychiatrists never actually met him, and (b) their testimony was based purely on a hypothetical scenario. Finally, Barefoot claimed that psychiatrists,

[3] For detailed discussion concerning the role that predictions of future dangerousness play in capital sentencing, see [6] and [7].

[4] *People v. Murtishaw,* 631 P.2d (Cal. 1981).

[5] *Barefoot v. Estelle*, 463 U.S. 880 (1983).

[6] It is worth pointing out that Dr. James P. Grigson is a particularly controversial individual. During his career, he appeared in at least 150 capital trials on behalf of the state. Moreover, his clinical predictions of future dangerousness were used in the trials of nearly one-third of all Texas death row inmates. For more on Dr. Grigson's controversial role in Texas death penalty cases, see [8].

[7] *Barefoot* 463 U.S. at 918–19 (Blackmun, J., dissenting).

[8] *Id.* at 919 (Blackmun, J., dissenting).

[9] *Id.* (Blackmun, J., dissenting).

[10] *Barefoot v. Estelle*, 463 U.S. 883 (1983).

[11] According to the Texas statute in question—namely, Tex. Code Crim.Proc., Art. 37.071—jurors are given three threshold questions to answer during the sentencing phase of capital trials. One threshold requires the jury to make a judgment concerning the probability that the defendant would pose a continued threat to society in the future. The other two threshold questions were, (a) whether the defendant killed the victim(s) both knowingly and deliberately; and (b) in the event that the defendant was responding to a provocation by the victim(s), whether the defendant's response was unreasonable or disproportionate given the nature of the provocation. If the jury unanimously finds that the state has proved each of these three issues beyond a reasonable doubt, the defendant automatically receives the death penalty rather than life in prison.

[12] *Jurek v. Texas,* 428 U.S. 262 (1976).

as a group, were not qualified to make reliable predictions concerning future dangerousness. This latter claim—a claim that the United States Supreme Court ultimately rejected—is the most salient for present purposes.

The Court's decision on this front was especially surprising given than the American Psychiatric Association filed an amicus brief which stated that psychiatrists, both individually and as a group, were not competent to make predictions concerning future dangerousness.[13] Indeed, the Association claimed that their best estimate was that clinical predictions of violent recidivism were typically wrong "two out of three" times.[14] The Court acknowledged that "many mental health professionals have questioned the usefulness of psychiatric predictions of future dangerousness in light of studies indicating that such predictions are often inaccurate."[15] The Court nevertheless found that the testimony from Dr. Holbrook and Dr. Grigson was acceptable under the Supreme Court's existing death penalty jurisprudence. Writing for the majority, Justice White adopted the following line of reasoning:

> The suggestion that no psychiatrist's testimony may be presented with respect to a defendant's future dangerousness is somewhat like asking us to disinvent the wheel. In the first place, it is contrary to our cases. If the likelihood of a defendant's committing further crimes is a constitutionally acceptable criterion for imposing the death penalty, which it is, *Jurek v. Texas, 428 U.S. 262* (1976), and if it is not impossible for even a lay person sensibly to arrive at that conclusion, it makes little sense, if any, to submit that psychiatrists, out of the entire universe of persons who might have an opinion on the issue, would know so little about the subject that they should not be permitted to testify… Acceptance of petitioner's position that expert testimony about future dangerousness is far too unreliable to be admissible would immediately call into question those other contexts in which predictions of future behavior are constantly made.[16]

The Court went on to dismiss the aforementioned amicus brief filed by the American Psychiatric Association in the following way:

> Neither petitioner nor the Association suggests that psychiatrists are always wrong with respect to future dangerousness, only most of the time. Yet the submission is that this category of testimony should be excised entirely from all trials. We are unconvinced, however, at least as of now, that the adversary process cannot be trusted to sort out the reliable from the unreliable evidence and opinion about future dangerousness, particularly when the convicted felon has the opportunity to present his own side of the case.[17]

The Court concluded that the adversarial nature of our legal system was sufficient to address the concerns raised by the petitioner with respect to the general reliability of predictions of future dangerousness. Thus, the decision in *Barefoot* established that violence risk assessments are admissible in capital sentencing.

This decision was controversial, and we take no stand on whether it was justified. For better or for worse, the law currently allows capital sentences to be based on predictions of violence. Given that life and death hang in the balance in this context, it is incumbent upon both the scientific community and legal decision makers to ensure that if predictions of violence are going to continue to play any role in capital sentencing, these predictions should be as valid and reliable as possible so long as the methods used to make better predictions do not generate any additional moral or legal concerns of their own (see "Evidentiary Issues", "Constitutional Issues", "Moral Issues").[18]

## Violence Risk Assessment and Civil Commitment

Predictions of violence also play a role in the non-criminal context of involuntary civil commitment—i.e., "the state-sanctioned involuntary hospitalization of mentally disordered individuals who are thought to need treatment, care, or incapacitation because of self-

[13] *Barefoot,* 463 U.S. at 899.
[14] *Id.* at 920 (Blackmun, J., dissenting).
[15] *Id*. at 906 (fn.7).
[16] *Barefoot*, 463 U.S. at 897.
[17] *Id.* at 901.
[18] For recent overviews of the role that predictions of future dangerousness play in capital sentencing, see [9–11].

harming or antisocial tendencies" ([12], p. 297). Every state has a statutory scheme for determining when mentally disordered individuals can be forcibly hospitalized in psychiatric facilities.[19] Typically, in order to qualify for involuntary civil commitment, an individual must (a) have a mental illness or disorder, and (b) pose a potential threat to himself or others. Given the deprivation of liberty involved in civil commitment, it shares some salient features with criminal detention.

There are also several important differences, "including differences in the jurisprudential basis for the state's intervention, the definition of behavior that may trigger that intervention, the process by which the state accomplishes intervention, and the duration of the intervention" ([12], p. 297). Whereas the authority of the criminal law is grounded in the state's police power—i.e., its power to compel obedience to the law with the use of legal sanctions—civil commitment has traditionally been grounded in the state's so-called *parens patriae* powers to act as a guardian for both children and the mentally disordered. Unlike the criminal law, which focuses primarily on punishing offenders for past behavior, civil commitment focuses on preventing individuals from harming themselves or others in the future. Thus, civil commitment is inherently forward-looking. Moreover, because we cannot specify in advance when a patient will be psychologically healthy enough to be safely released and reintegrated into society, civil commitment necessarily involves indeterminate periods of hospitalization. This marks another important difference between civil commitment and criminal detention, since criminal sentences are typically determinate (or at least loosely determinate).

In light of the asymmetries between criminal punishment and civil commitment, the courts have typically held the two to different constitutional and evidentiary standards. Consider, for instance, the landmark mental health law case *Addington v. Texas*.[20] Frank Addington had been arrested on misdemeanor charges for threatening his mother, who subsequently filed a petition with the court to have her son involuntarily committed to a state psychiatric hospital. The State presented evidence that Addington (a) had a long history of mental illness, (b) had previously spent time in psychiatric facilities, (c) threatened to injure his parents in the past, (d) had been involved in several prior assaultive episodes while hospitalized, (e) refused outpatient therapy, and (f) had already tried before to escape from psychiatric facilities. The State also presented the testimony of two psychiatrists who both claimed that, because Addington suffered from psychotic schizophrenia and paranoid delusions, he posed a continued threat to himself and/or others. The trial judge then instructed the jury to answer the following two questions:

1. "Based on clear, unequivocal and convincing evidence, is Frank O'Neal Addington mentally ill?"[21]
2. "Based on clear, unequivocal and convincing evidence, does Frank O'Neal Addington require hospitalization in a mental hospital for his own welfare and protection or the protection of others?"[22]

The jury answered both questions affirmatively, so Addington was indefinitely committed to a state psychiatric facility. He appealed based on the claim that the jury should have been instructed to rely on the "beyond a reasonable doubt" standard used in criminal law rather than the less stringent "clear and convincing evidence" standard used by the judge and jurors in his case.

Ultimately, the United State Supreme Court found that civil commitment was sufficiently different than criminal detention so as not to require the "beyond a reasonable doubt" standard. Writing for the majority in *Addington*, Justice Burger pointed out that the Court once again found itself in the familiar role of having to balance competing interests. On the one hand, civil commitment constitutes "a significant deprivation of liberty"[23] that requires some due process protection. On the other hand, the Court also acknowledged that the state has a legitimate interest in protecting individuals who are unable to care for themselves—especially when these individuals pose a threat to themselves or others. The best way to balance these two competing interests, according to the Court, was to adopt the intermediate "clear and

[19] State civil commitment statutes are compiled at http://www.psychlaws.org/LegalResources/Index.html

[20] *Addington v. Texas* 441 U.S. 418 (1979).

[21] *Addington v. Texas* 441 U.S. 421 (1979).

[22] *Id.*

[23] *Id.*

convincing evidence" standard in civil commitment hearings. On their view, the "beyond a reasonable doubt" standard sets the bar too high, whereas the "preponderance of evidence" standard sets it too low. The Court's remarks about the relationship between medical and legal standards of evidence are especially germane here:

> The subtleties and nuances of psychiatric diagnosis render certainties virtually beyond reach in most situations. The reasonable-doubt standard of criminal law functions in its realm because there the standard is addressed to specific, knowable facts. Psychiatric diagnosis, in contrast, is to a large extent based on medical "impressions" drawn from subjective analysis and filtered through the experience of the diagnostician. This process often makes it very difficult for the expert physician to offer definite conclusions about any particular patient. Within the medical discipline, the traditional standard for "fact finding" is a "reasonable medical certainty." If a trained psychiatrist has difficulty with the categorical "beyond a reasonable doubt" standard, the untrained lay juror—or indeed even a trained judge—who is required to rely upon expert opinion could be forced by the criminal law standard of proof to reject commitment for many patients desperately in need of institutionalized psychiatric care. Such "freedom" for a mentally ill person would be purchased at a high price.[24]

Practical limitations in psychiatric evidence thus motivated the Court's adoption of the lesser standard of "clear and convincing evidence" for the purposes of civil commitment hearings.

Regardless of whether one agrees with the decision in *Addington*, it nevertheless established that potential detainees in civil commitment hearings are legally entitled to some safeguards but fewer safeguards than defendants in criminal cases. Thus, predictions of violence by mental health professionals are currently admissible for the purposes of civil commitment as long as they meet the "clear and convincing" standard required by *Addington*. In addition, these predictions cannot be based on classifications such as race or ethnicity that have been deemed suspect under the Fourteenth Amendment.[25] Still, within these limits, relevant predictions of violence need only to be "clear and convincing" in order to be admissible in the context of civil commitment hearings.

## Violence Risk Assessment and Sexual Predator Statutes

Ever since Michigan passed the first "sexual psychopathy law" in 1937, other states subsequently adopted similar special sentencing provisions for sex offenders. These "mentally disordered sex offender statutes" were designed to serve two primary purposes—namely, to protect society from so-called "sexual predators" and to provide treatment to sex offenders in a rehabilitative setting as an alternative to punishment. Traditionally, sex offenders were either diverted into treatment immediately after conviction or they were diverted into treatment after arrest but before conviction. More recently, however, several states have controversially enacted statutes that "provide for coerced confinement of sex offenders not as an alternative to incarceration…but subsequent to completion of incarceration" ([12], p. 261).

The Kansas Sexually Violent Predator Act, for instance, defines a sexually violent predator as "any person who has been convicted of our charged with a crime of sexual violence and who suffers from a mental abnormality or personality disorder which makes the person likely to engage in predatory acts of sexual violence if not confined in a secure facility."[26] Unlike traditional sex offender laws, however, the statutory scheme adopted by Kansas enabled the state to detain potentially dangerous sex offenders even though (a) these offenders may not satisfy the normal standards for civil commitment, and (b) these offenders have already served out their prison sentences. The Kansas legislators explained their motivation in the following way:

> [A] small but extremely dangerous group of sexually violent predators exist who do not have a mental disease or defect that renders them appropriate for involuntary treatment pursuant to the [general involuntary civil commitment statute] . . . . In contrast to persons appropriate for civil commitment under the [general involuntary civil commitment statute], sexually violent predators generally have anti

[24] *Addington v. Texas* 441 U.S. 430 (1979).
[25] See, e.g., [13].
[26] Kan. Stat. Ann. § 59-29a02(b) (1994).

> social personality features which are unamenable to existing mental illness treatment modalities and those features render them likely to engage in sexually violent behavior. The legislature further finds that sexually violent predators' likelihood of engaging in repeat acts of predatory sexual violence is high. The existing involuntary commitment procedure . . . is inadequate to address the risk these sexually violent predators pose to society. The legislature further finds that the prognosis for rehabilitating sexually violent predators in a prison setting is poor, the treatment needs of this population are very long term and the treatment modalities for this population are very different than the traditional treatment modalities for people appropriate for commitment under the [general involuntary civil commitment statute].[27]

In 1997, the United States Supreme Court reviewed this statutory scheme in *Kansas v. Hendricks*.[28] Leroy Hendricks—who was the first person tried under the new Kansas law—had been convicted in 1972 of taking "indecent liberties" with two 13-year old boys. At the end of his prison sentence in 1994, Hendricks was scheduled to be released to a half-way house. Before his release, however, the State filed a petition seeking Hendricks' civil commitment as a sexually violent predator.

During the trial to determine his status as a sexual predator, Hendricks openly admitted that he had repeatedly sexually abused children in the past and he also stated that he was often unable to "control the urge" to molest children. Moreover, he claimed that the only thing that could prevent him from reoffending in the future was death. Indeed, not only did Hendricks agree with his diagnosis as a pedophile, but he also told the state physician who made the diagnosis that he believed that "treatment is bullshit." Partly in light of Hendricks' testimony concerning his own future dangerousness, the jury unanimously found that Hendricks was indeed a sexual predator. The trial court ordered him to be involuntarily and indefinitely committed.

Hendricks subsequently challenged the trial court's decision on due process, double jeopardy, and *ex post facto* grounds. His case eventually made its way to the United State Supreme Court. One of the main debates in *Hendricks* centered on whether the Supreme Court's prior decision in *Foucha v. Louisiana*[29] required that a person be both mentally ill and likely to be dangerous before being civilly committed. Justice Thomas, writing for the 5-4 majority in *Hendricks*, held that Kansas did not have to show that a sexually violent predator was mentally ill under any medical diagnosis. Instead, a sexually violent predator could be committed, even after incarceration, merely on the basis of "some additional factor," such as "mental abnormality."[30] The statutory scheme in Kansas defined "mental abnormality" as "[a] congenital or acquired condition affecting the emotional or volitional capacity which predisposes the person to commit sexually violent offenses in a degree constituting such person a menace to the health and safety of others."[31] Requiring a "mental abnormality," Thomas stated, subjects only "those who are unable to control their dangerousness" to commitment.[32]

As such, the Court ultimately rejected Hendricks' claim that his due process rights had been violated.[33] On their view, so long as a commitment statute requires both proof of dangerousness and proof of some additional factor—whether it be a mental illness or merely a mental abnormality—it satisfies the due process standards that were established by their earlier decision in *Foucha*. Thomas summarized the Court's stance on this front as follows:

> To the extent that the civil commitment statutes we have considered set forth criteria relating to an individual's inability to control his dangerousness, the Kansas Act sets forth comparable criteria and Hendricks' condition doubtless satisfies those criteria. The mental health professionals who evaluated Hendricks diagnosed him as suffering from pedophilia, a condition the psychiatric profession itself classifies as a serious mental disorder.…Hendricks even conceded that, when he becomes "stressed out," he

[27] Kan. Stat. Ann. §59-29a01 (1994).
[28] *Kansas v. Hendricks*, 521 U.S. 346 (1997).
[29] *Foucha v. Louisiana,* 504 U.S. 71 (1992).
[30] *Kansas v. Hendricks, supra,* at 358.
[31] Kan. Stat. Ann. § 59-29a02(b) (1994).
[32] *Kansas v. Hendricks, supra,* at 358.
[33] The Court also rejected Hendricks' claim that the Kansas statute runs afoul of prohibitions against double jeopardy and ex post-fact law making. Because the statute was civil in intent and design rather than criminal, the Court found that Hendricks' worries on these two fronts were groundless. For present purposes, discussing their arguments on this front would take us too far afield.

> cannot "control the urge" to molest children. This admitted lack of volitional control, coupled with a prediction of future dangerousness, adequately distinguishes Hendricks from other dangerous persons who are perhaps more properly dealt with exclusively through criminal proceedings. Hendricks' diagnosis as a pedophile, which qualifies as a "mental abnormality" under the Act, thus plainly suffices for due process purposes.[34]

On the surface, the holding in *Hendricks* appears to conflate a finding of future dangerousness with the finding of a "mental abnormality"—which raises obvious worries about circularity.[35] Indeed, it is difficult to find a recent Supreme Court decision that has been as widely criticized as *Hendricks* by both legal scholars and mental health professionals alike.[36] However, examining all of the objections to *Hendricks* that have been raised in the literature would take us to far afield.

The important take-home lesson for present purposes is that regardless of whether one agrees with the Court's decision in *Hendricks*, as things presently stand, predictions of future dangerousness play an essential role in yet another high stakes legal context. Perhaps the most salient lingering issue when it comes to the new wave of controversial sex offender statutes is the amount of proof required for an adequate determination of future dangerousness. After all, insofar as "mental abnormality" is defined at least in part in terms of whether an offender will be able to control his behavior in the future, legal decision makers are once again left to rely on violence risk assessment. And while the standard varies from state to state, in general the bar for determining the future dangerousness of sex offenders is relatively low.

Whereas some states such as New Jersey have adopted vague standards which require only that an offender is "likely to engage in acts of sexual violence,"[37] others have required a bit more precision when it comes to determinations of future dangerousness. The California Supreme Court, for example, held that a State need only establish that the offender posts a "serious" or "well-founded risk[38]—even if the chances of reoffense are less likely than 50%.[39] Washington, on the other hand, raises the bar slightly, requiring the likelihood of reoffense to be "more than 50%."[40] Given how much is at stake in these contexts, we believe the current state of affairs on this front ought to give us pause for concern. Minimally, we think that in order for justice to be adequately served, legal decision makers need to be equipped with the best possible predictions concerning future dangerousness. As we saw earlier when discussing both capital sentencing and civil commitment, unless and until more progress is made when it comes to the science behind violence risk assessment, our legal system will continue to produce otherwise avoidable miscarriages of justice whereby dangerous people are sometimes imprudently set free and harmless people are sometimes unfairly detained. It is with that in mind that we now turn our attention to the recent advances that have been made in the field of violence risk assessment.

## Clinical vs. Actuarial Violence Risk Assessment

As we have seen, violence risk assessment currently plays an important role in both criminal and non-criminal legal contexts. Unfortunately, the historical track record of predictions of violence is particularly underwhelming. Some commentators in the past have even gone so far as to suggest that relying on psychiatric predictions of violence is tantamount to "flipping coins in the courtroom" [17]. However, when exploring the legal role played by violence risk assessment, we must first distinguish clinical assessment from actuarial assessment. Meehl [18] draws the

[34] *Kansas v. Hendricks*, supra, at 360.

[35] Given the problems with circularity, it is perhaps unsurprising that the United States Supreme Court had to revisit the statutory scheme in Kansas five years later in *Kansas v. Crane*, 534 U.S. 407 (2002). In *Crane*, the Court was supposed to address the issue of how much, if any, volitional impairment was required before a sex offender could be classified as a sexual predator and indefinitely detained. At the end of the day, however, the Court refused to define with any "mathematical precision" what constituted a lack of control.

[36] See, e.g., [14–16].

[37] New Jersey Statutes Annotated Title 30, §4–27.26.

[38] *People v. Superior Court (Ghilotti)*, 27 Cal.4th 888 (2002).

[39] *Id.*

[40] *In re Detention of Brooks*, 145 Wash. 2d 275 (2001) (overruled on other grounds by *In re Detention of Thorell*, 149 Wash. 2d 724).

distinction between the two along the following lines:[41]

> The mechanical combining of information for classification purposes, and the resultant probability figure which is an empirically determined relative frequency, are the characteristics that define the actuarial or statistical type of prediction. Alternatively, we may proceed on what seems, at least, to be a very different path. On the basis of interview impressions, other data from the history and possibility of psychometric information of the same type as in the first type of prediction, we formulate, as in psychiatric staff conference, some psychological hypotheses regarding the structure and dynamics of this particular individual…. This type of procedure has been loosely called the clinical or case study method of prediction. (pp. 3-4)

In other words, whereas clinical risk assessment employs "intuitive" and "subjective" methods, actuarial risk assessment employs "mechanistic" and "automatic" methods ([19], p. 64). According to this way of carving out the difference between the two general approaches, "actuarial tables spell out precisely what kinds of data are to be considered in the prediction, while the clinical approach appears to let the choice of data vary somewhat with the individual case" ([19], p. 64).

In a typical case of clinical risk assessment, a mental health professional examines the patient's criminal record and then interviews the patient. Sometimes the patient's friends and family are interviewed as well. The defining feature of this method is that it is driven by the unstructured interplay between the facts pertaining to the individual case at hand and the clinician's trained intuitions concerning which unique features of the case are salient to the likelihood that the patient will commit violent acts in the future. Dix [20] identifies the following factors that commonly drive clinical predictions of future behavior: (a) acceptance of guilt and/or responsibility, (b) development of ability to articulate resolution of stress-producing situations, (c) fantasies, (d) behavior during detention/hospitalization, (e) duration of institutionalization, (f) achievement of maximum benefits of institutionalization, (g) change in community circumstances, and (h) seriousness of anticipated conduct. However, as Monahan [19] points out, "It is important to distinguish between the factors clinicians believe they are using—correctly or incorrectly—to predict violent behavior and the factors that actually appear to influence their decisions" (p. 31).

The primary weakness of the unstructured clinical method for predicting violence is described by Krauss and Sales [21] in the following way:

> In addition to relying on cognitive biases and heuristics that affect the judgments of ordinary people under conditions of uncertainty…, mental health practitioners have been found to poorly combine information, use irrelevant information, and inappropriately vary the information they use in formulating predictions for an individual. Worse, their propensity for gathering excessive and irrelevant information also likely leads mental health practitioners to have greater confidence in their conclusions than is warranted. (p. 279; references omitted)

As a result, clinical predictions of violence perhaps unsurprisingly tend not to be consistent from one mental health professional to the next. Moreover, to the extent to which they have been consistent, they have repeatedly been found to be consistently bad. As Monahan pointed out over 30 years ago:

> It would be fair to conclude that the "best" clinical research currently in existence indicates that *psychiatrists and psychologists are accurate in no more than one out of three predictions of violent behavior over a several-year period among institutionalized populations that had both committed violence in the past (and thus has high base rates for it) and who were diagnosed as mentally ill.* ([19], pp. 48-49; emphasis in original)

In an effort to explain why clinical risk assessment is so unreliable, Monahan identifies what he takes to

[41] In this section, the key terms are used with their usual technical meanings: (a) reliability=df "the consistency or stability of a measure from one use to the next"; (b) validity = df "accuracy of measurement—the degree to which as assessment measures what it is supposed to"; (c) incremental validity = df "the amount that validity is improved with the addition of new information"; (d) predictor variables=df "categories consisting of different levels that are presumed to be relevant to what is being predicted"; (e) base rate=df "the proportion of people in some population during a specified time period of time who fall into the criterion category that is to be predicted—e.g., violent recidivism."

be "the four most common blind spots" of the clinical method—namely, (a) a lack of specificity in defining the criterion being used; (b) a failure to adequately take statistical base-rates into consideration; (c) a reliance on bogus correlations; and (d) a failure to adequately account for situational and environmental factors. ([19], p. 32)

The main alternative to clinical predictions of future violence is actuarial violence risk assessment. Exploring all of the actuarial models that have recently been developed would take us too far afield, so we will limit our attention to one of the most recent and promising tools—namely, the Classification of Violence Risk (COVR) Software that was developed by Monahan and colleagues as part of the MacArthur Study of Mental Disorder and Violence.[42] The MacRisk study was a large-scale project that assessed 939 male and female patients in acute civil psychiatric facilities[43] based on 134 potential risk factors for violent behavior[44]—factors which fell into the following four general domains ([22], p. 2):

1. Dispositional variables—i.e., demographic factors such as age and gender as well as personality factors such an impulsivity and anger control.
2. Historical variables—i.e., factors such as family history, work history, mental hospitalization, and history of violence.
3. Contextual variables—i.e., factors such as current social supports, social networks, and other environmental elements.
4. Clinical variables—i.e., factors such as mental disorder, personality disorder, drug and alcohol abuse, and level of functioning.

During the MacRisk study, Monahan and colleagues followed patients in the community for 20 weeks after they were released. Measures of violence included patient self-reports (at 10 weeks and 20 weeks post-discharge, respectively), official police and hospital records, and reports from collaterals in the community such as the patients' friends and family members.

In analyzing the MacRisk data, Monahan and colleagues developed a model of violence risk assessment that was based on an iterative classification tree (ICT) method rather than the more commonly used method of linear regression. In contrasting these two general methods, Monahan et al. [1] make the following remarks:

> We present an approach to actuarial violence risk assessment based on the use of classification trees…[A] classification tree analysis reflects an interactive and contingent model of violence, one that allows for many different combinations of risk factors to classify a person as high or low risk…[b]ased on a sequence established by the classification tree, a first question is asked of all persons being assessed. Contingent on each person's answer to that question…one or another second question is posed, and so on, until each subject is classified into a high or a low risk category. This contrasts with a regression approach in which a common set of questions is asked of everyone being assessed and every answer is weighted to produce a score that can be used for the purposes of categorization. (p. 92)

By pooling and reanalyzing cases via the ICT method, researchers were ultimately able to group every patient in the study into one of five risk classes for which the prevalence of violence during the first 20 weeks post-discharge was 1%, 8%, 26%, 56%, and 76%, respectively.[45] One of the key benefits of the ICT approach is that it enables researchers to focus more narrowly on specific sub-classes of risk.

Another key benefit of the ICT approach is that it naturally lends itself to software applications. Consequently, Monahan and colleagues were able to develop the first software application for actuarial violence risk assessment—namely, COVR—which they describe in the following way:

> The Classification of Violence Risk (COVR) was developed with the goal of offering clinicians an actuarial "tool" to assist in their predictive decision making. The COVR is an interactive software program designed to estimate the risk that an acute psychiatric patient will be violent to others over the next several months after discharge from the hospital. Using a laptop or desktop computer, the COVR guides

[42] For brevity's sake, we are going to call this study MacRisk, for short. See [1] for the full details of the MacRisk study.

[43] The patients—all of whom were of white, African-American, or Hispanic ethnicity—were initially institutionalized in facilities in Pittsburgh, Kansas, and Worcester.

[44] For a complete list of the risk factors, see [1] Appendix B.

[45] The overall base rate for violent reoffending for the entire group of patients twenty weeks after discharge was 18.7%. See, [1] for more details.

> the evaluator through a brief chart review and a 5–10 min interview with the patient. After the requested information has been entered, the COVR generates a report that contains a statistically valid estimate of the patient's violence risk, including the confidence interval for that estimate and a list of the risk factors that the COVR took into account to produce the estimate. ([23], p. 721)[46]

COVR enables researchers to assess individuals based on 40 risk factors.[47] However, because of the nature of the ICT method, the specific questions an individual is asked will depend on his answers to prior questions. As such, risk factors that may be used to assess risk in some individuals may not be used to assess risk in other individuals. In this sense, the ICT method that is the backbone of COVR allows researchers to assess individuals in a more efficient manner since only those risk factors that are applicable to a specific individual are factored into the prediction.

Nevertheless, COVR is not without its limitations. For instance, Monahan et al. [23] make the following candid remarks:

> We cannot stress strongly enough that the COVR software was constructed and has been validated only on samples of psychiatric inpatients in acute facilities in the United States who would soon be discharged into the community. Whether the validity of the model can be generalized to other people (e.g. people without mental disorder, people outside the United States) or to other settings (e.g. outpatient settings, criminal justice settings) remains to be determined empirically. Until such evidence is available—and a number of projects are underway to generate the required evidence—use of the model should be restricted to acute inpatient populations. (p. 729)

So, while COVR may be suitable for the purposes of civil commitment hearings, it is not yet ready for use in the context of the criminal law. Until researchers establish that COVR's impressive results with acute psychiatric inpatients generalize to criminal populations, its legal application will admittedly be limited. We nevertheless think COVR's success thus far serves as an illustrative example of the potential power and promise of actuarial models of violence risk assessment. However, despite the progress that has been made when it comes to actuarial risk assessment, actuarial models such as COVR are not without their critics.

## Actuarial Risk Assessment and the Problem of Individualization

Given the high stakes that are sometimes involved when it comes to predictions of future dangerousness—e.g., capital sentencing, civil commitment hearings, and post-imprisonment hearings for sexual predators—it is very important that legal decision makers take full advantage of the best available scientific evidence at their disposal. As we saw in the previous section, the gathering data make it clear that actuarial models outperform their clinical counterparts. Unfortunately, clinical predictions nevertheless continue to be the preferred method of assessing risk for the purposes of the law. An obvious question now arises: "If actuarial or statistical prediction has advantages over the clinical approach in terms of precision, reproducibility, or efficiency, why has clinical prediction dominated the legal system?" ([19], p. 82) In answering this question, it will be helpful to examine some of the salient research that has been done on the predominance of clinical assessment when it comes to legal decision making.

In one set of studies by Krauss and Sales [21], "a simulated capital sentencing case was presented to mock jurors using both written and videotaped materials, and the influence of expert testimony on final mock juror dangerousness decisions was assessed using a number of dependent measures" (p. 283). The results of these studies suggest that people have "a special affinity for case information, a distrust of statistics, or bias against complex information," despite the fact that "case-specific information is often more inaccurate than statistical information" ([21], p. 275). Moreover,

> [C]linical opinion expert testimony was demonstrated to be more influential on mock jurors' dangerousness decisions than actuarial expert testimony. Mock jurors were found to be more influenced by clinical opinion expert testimony in their dangerousness ratings both directly after its presentation and after adversary manipulations designed to reduce that influence. Additionally, a bias in favor of the clinical opinion expert testimony was supported by mock jurors'

[46] See [1] for further details concerning the development and validation of COVR.

[47] The entire list of factors can be found in Table 6.3 in [1].

> ratings of the two types of testimony on a number of characteristics (credibility, influence, level of science, and persuasiveness). ([21], p. 300)

Krauss and Lee [24] later found that mock jurors' preference for clinical predictions over actuarial predictions "remained even after cross-examination and competing expert testimony manipulations" (p. 116). In short, the gathering data suggest that mock jurors are more influenced and impressed by clinical predictions of future violence than they are by the markedly more powerful actuarial predictions. This troubling state of affairs is unfortunately not limited to mock jurors. In a study involving judges, prosecutors, and defense attorneys, Redding et al. [25] similarly found that these legal decision makers "were relatively disinterested in statistical or actuarial data as compared to other types of testimony" (p. 592) and that they also "did not appreciate the value of research evidence, believing instead that nomothetic research had no bearing on individual cases" (p. 592).

One possible explanation for why legal decision makers do not like actuarial assessment is that they see it as too *impersonal* for the purposes of the law. Monahan [19] explains this worry in the following way: "A philosophical problem frequently arises in actuarial prediction concerning the legitimacy of inferring statements about an individual case from the fact that a person belongs to a certain class of cases that have *x* probability of violence" (p. 65). According to this line of reasoning, legal decision makers are asked to make judgments concerning *specific individuals as such*, so it is purportedly not enough simply to point out that an individual happens to fall into a general class including other people who recidivated in the past. Rather, we need to focus exclusively on the traits and characteristics of the individual presently on trial. Clinical assessment is allegedly well-suited for this task. Actuarial assessment, on the other hand, is allegedly ill-suited because it considers the individual only insofar as he is similar to members of a particular group.

We find this objection to actuarial assessment puzzling. To see why, consider the following dilemma. Those who are worried about the problem of individualization must believe either (a) that clinicians should not rely on any past experiences with similarly situated patients when making predictions about a particular patient *P*, or (b) that clinicians should rely on past experiences with people similarly situated as *P*. If the critic of actuarial assessment opts for (a), it is unclear what clinical predictions are supposed to be based upon. Without some salient contrast classes or individuals, one has no guidance in the present case involving *P*. After all, the individual features of *P* that lead the clinician to conclude that *P* is likely to be violent in the future are presumably highlighted precisely because the clinician has learned via training and experience that these features have been predictive of violent behavior with other similarly situated people in the past. As Slobogin [13] points out, "while clinicians look at individual patterns, they do not do so in a vacuum. Rather they make comparisons—sometimes implicit, sometimes explicit—between these patterns and the patterns of other individuals or groups of individuals that they know about through experience, training, and education" (p. 126). In short, (a) is a particularly hard pill to swallow because it seems to rule out any rational basis for prediction.

Although (b) is more appealing, once we allow that clinicians should rely on past experiences with similar cases, this opens the door to considering non-individualized features of *P*, which in turn opens the door to actuarial assessment. Moreover, once it is clear that clinical assessment is no less dependent on inferences based on class membership than actuarial assessment, the worry about individualization loses much of its force. As Meehl [18] observed more than 50 years ago, "if nothing is rationally inferable from membership in a class, no empirical prediction is ever possible" (p. 20). So, if reliance on data concerning group membership renders actuarial assessment problematic for the purposes of the law, it creates no fewer problems for clinical assessment.

Given that actuarial assessment is more structured and hence less prone to individual bias and subjective intuition, some commentators have suggested that it should be used instead of clinical assessment. Others favor a "structured clinical approach" whereby actuarial models are used but a "clinical override" is nevertheless called for when important case-specific factors happen not to be built into the particular model being used.[48] For present purposes, we need not take a stand on the debate between advocates of structured

[48] For more on the proper relationship between actuarial and clinical methods, see [26–29].

clinical methods and others who favor pure actuarial methods. Instead, we merely want to highlight the fact that (a) predictions of future violence are commonplace in several high stakes legal contexts, and (b) legal decision makers prefer clinical assessment to actuarial assessment even though the latter has been shown to be more valid and reliable than the former. The issue that we want to examine now is whether neuroscience might be enable us to develop more powerful tools for violence risk assessment and perhaps even help address its image problem in the eyes of the law.

## The Neural Correlates of Psychopathy

The problem of violence is as multifaceted and complex as it is costly to society. We are just now starting to develop a deeper understanding of the myriad elements that are involved—elements that span multiple explanatory levels ranging from faulty neurotransmitters to impoverished neighborhoods. Neuroscientists have made tremendous progress in the past two decades in identifying and exploring some of the neural correlates of violence and aggression. However, trying to survey all of the progress that has been made on this front would take us too far afield.[49] So, for present purposes, rather than focusing on the neuroscience of violence more generally, we are going to focus more narrowly on the recent work done on the neural correlates of psychopathy and the unique role played by psychopathy in violence risk assessment.

Individuals with psychopathy are especially germane to our present discussion for several reasons. First, psychopathy is a developmental disorder that often leads to persistent antisocial behavior. Second, individuals with psychopathy are notoriously domineering, exploitative of others, and deficient (or entirely lacking) in emotions such as guilt, remorse, and empathy.[50] As such, they are stunningly hyper-aggressive, predatory, and recidivistic.[51] Despite the fact that only 1% or less of the population is thought to be afflicted with psychopathy, some estimates suggest that individuals with psychopathy could nevertheless be responsible for as much as 30%–40% of all violent crime.[52] Second, there has been a lot of recent neuroscientific research on psychopathy that we believe could be used to shed much needed light on some of the moral, legal, and policy issues that arise with respect to psychopathic individuals. Finally, the construct of psychopathy has had a major impact on violence risk assessment. For instance, it is the only clinical disorder that has been shown to confer increased risk for both reactive and instrumental aggression.[53] Hence, we believe that recent and future neuroscientific research on psychopathy holds out the promise for more accurate and reliable models for predicting violence.

To understand this promise, we first need to specify what it means for an individual to be a psychopath. The most natural place to begin our investigation is with Robert Hare—a pioneer and still leader in the field of psychopathy research—who developed the most widely used diagnostic tool for psychopathy research, namely, the Psychopathy Checklist-Revised (PCL-R) [31].[54] The PCL-R is a clinical scale that relies on a semi-structured interview, information about a person's case-history, and a 20 item scale where each item is scored 0, 1, 2.[55] Total scores can range from 0 to 40 and reflect an estimate of the degree to which the individual matches the prototypical psychopath.[56] Eighteen of the 20 items form four factors (or dimensions or

[49] For a recent meta-analysis of the neuroimaging work that has been done on violence and aggression, see [30].
[50] See, e.g., [31, 32].
[51] See, e.g., [33].
[52] See, e.g., [34, 35].
[53] The majority of violent acts are *reactive* in nature and perpetrated by impulsive men who are easily aroused and who often satisfy the diagnostic criteria for Antisocial Personality Disorder (ASPD). See, e.g., [36]. But there is an important distinction to be drawn between this kind of impulsive violence that usually occurs "in the heat of the moment" and the much less common and more worrisome kind of premeditated and instrumental violence that is commonly associated with psychopathy.
[54] For more on the development and psychometric properties of the PCL-R, see [31, 37].
[55] While the PCL-R is the most widely used tool for measuring psychopathy—which is why we have chosen to focus on the PCL-R in this paper—other useful tools have been developed. See, e.g., the Self-Report Psychopathy Scale III (SRP-III; [38]); the Psychopathic Personality Inventory (PPI; [39]).
[56] The *PCL-R Manual* lists the mean score for North American prison samples and for forensic psychiatric samples as 23.6 (SD=7.9) and 20.6 (SD=7.8), respectively [31].

facets)[57]: Interpersonal (glibness/superficial charm, self-grandiosity, pathological deceptiveness, conning/manipulative); Affective (lack of guilt or remorse, callous/lack of empathy, shallow affect, refusal to accept responsibility); Lifestyle (need for stimulation/proneness to boredom, parasitic lifestyle, failure to make realistic long-term goals, impulsivity, irresponsibility); and Antisocial (poor behavioral control, early onset behavioral problems, juvenile delinquency, revocation of conditional release, criminal versatility). It is worth noting that two of the 20 items—sexual promiscuity and multiple short term relationships—do not load on any of the four factors. These items nevertheless contribute to one's overall score on the PCL-R.

Because high scores on the PCL-R have been repeatedly shown to confer an increased risk for violence,[58] the PCL-R (or some derivative) has been included as a predictor variable in several prominent actuarial models of violence risk assessment.[59] However, one of the primary draw-backs of the PCL-R is that it takes several hours to complete and requires experts to complete the test. In an effort to address this shortcoming, Hare and colleagues designed a short 12-item version called the PCL:SV that was used by Monahan et al. [1] as part of the aforementioned MacRisk study.[60] The PCL:SV has a two factor structure where each factor on the PCL:SV combines two factors of the PCL-R. Both the affective/interpersonal components and the socially deviant components are measured by six items. The Factor 1 items include superficial, grandiose, deceitful, lacks remorse, lacks empathy, and doesn't accept responsibility. The Factor 2 items include impulsive, poor behavioral controls, lacks goals, irresponsible, adolescent antisocial behavior, and adult antisocial behavior. The cut-off score for the PCL:SV is 18, which is comparable to a 30 on the PCL-R. In short, Hare's PCL:SV provides researchers with an efficient yet still powerful tool for diagnosing psychopathy—a diagnosis that can then be used to predict violence.[61]

For instance, Monahan et al. [1] found that when they used only scores on the PCL:SV to make predictions concerning future violence based on the MacRisk data, the AUC of the ROC analysis was .73, which indicates that "there is a 73% chance that a patient who becomes violent will obtain a higher score on the Hare PCL:SV than will a randomly chosen patient who does not become violent" (p. 68). In the final analysis, Monahan et al. [1] conclude that out of the 134 initial risk factors that were included in the MacRisk study, the single most powerful risk factor for differentiating high risk from low risk groups was the PCL:SV score (p. 108).[62]

These results comport with the gathering data on psychopathy and violence. For instance, in one of the most recent reviews of the sprawling literature, Leistico et al. [50], present the results of a meta-analysis that integrates the effect sizes from 95 non-overlapping psychopathy studies. Their primary finding was that "psychopathy was similarly predictive across different ages (adolescents vs. adults), study methodologies (prospective vs. retrospective), and different types of outcomes (institutional infractions vs. recidivism)" [50]. It is not enough, however, to know *that* psychopaths are persistently violent. What we ultimately want to understand is *why* they are such an intractably violent group. Cognitive neuroscientists have recently tried to do their part to shed light on this latter issue by using structural and functional imaging to study psychopathy.

For instance, there is gathering data that psychopathic individuals display the following functional

[57] Originally, Hare developed a two factor model of psychopathy—see, e.g., [31, 32, 40]—but more recently he has put forward a four factor model that was developed based on research involving nearly 7,000 psychopaths. The Interpersonal/Affective dimensions and the Lifestyle/Antisocial dimensions constitute the original Factor 1 and Factor 2, respectively. For more information concerning the four factor model see [41, 42].

[58] See, e.g., [43–45].

[59] For instance, VRAG [46] and HCr-20 [47] both used PCL-SV scores. PCL:SV was also used as a risk factor by the MacRisk researchers in developing the ICT approach. However, even though Monahan et al. [1] found that the PCL:SV was the strongest predictor of violence, it was *not* included as one of the risk factors of COVR since the goal of the latter was to enable researchers to make quick decisions concerning future dangerousness in a forensic setting.

[60] For more details, see [48].

[61] It is worth pointing out that while the PCL:SV takes less time to complete than the PCL:R, it still takes a couple of hours to complete.

[62] In a recent study, Edens et al. [49] pit the PCL:SV against the modified 9 item version of VRAG (minus PCL:SV). The ROC analysis revealed that whereas the area under the curve for the modified version of VRAG (minus PCL:SV) was only .58, the variance attributable to the PCL:SV was .75 ([49], p.370).

neurocognitive deficits: (a) reduced amygdala and vmPFC activity during aversive conditioning tasks[63] [51]; (b) impairment in passive avoidance learning tasks[64] and differential reward-punishment tasks[65] [52, 53]; (c) reduced amygdala activation during emotional memory [54]; (d) reduced activation in the anterior and posterior cingulate gyri, left inferior frontal gyrus, amygdala, and ventral striatum when encoding, rehearsing, and recognizing negatively valenced words [55]; and (e) reduced in the ventromedial prefrontal cortex and anterior temporal cortex when distinguishing between moral and non-moral images [56].

In light of the gathering data on both the structural and functional brain abnormalities associated with psychopathy two questions naturally arise: First, could we potentially develop pharmacological treatments to address the neural impairments associated with psychopathy? Second, are the impairments associated with psychopathy heritable? Fortunately, researchers are already making some progress on these two fronts. Consider, for instance, the following data concerning the neurochemistry of psychopathy:

1. Blair et al. [57] show that the neurotransmitter noradrenaline plays an important role in the deficits associated with psychopathy.
2. Rogers et al. [58] show that administering noradrenaline antagonists reduces the impact of aversive cues when making decisions.
3. Strange and Dolan [59] show that amygdala activity in response to emotional stimuli is also reduced by the administration of a noradrenaline antagonist.
4. Cima et al. [60] show differences in psychopathic and non-psychopathic inmates with respect to cortisol function.

This kind of research is exciting not only because it sheds important additional light on the overall problem of violence, but also because it might enable us to develop potential pharmacological treatments for psychopathy in the future.

Complementary research is being done on the heritability of psychopathy. Two recent studies have suggested that there is a genetic contribution to the disorder, especially when it comes to the callous-unemotional components of psychopathy [61, 62]. Moreover, Larsson et al. [63] recently ran a large adolescent twin study that found that the same four factors identified by Hare's four-factor model of psychopathy load onto a single genetic factor. So, while many questions about the neural and genetic underpinnings of psychopathy remain unanswered, it is already clear that psychopathy is one of the most powerful predictor variables for violence risk assessment. As such, by making progress in understanding the roots of psychopathy, we thereby place ourselves in a better position for addressing the problem of predicting violence.

## Cutting-Edge Data Collection: Genetically Informed Neuroimaging

To get a sense for what future research in this area might look like, we now want to turn our attention to the exciting interdisciplinary work being done on the relationship between violence and the MAOA gene—i.e., the so-called "warrior gene." The MAOA gene encodes the enzyme monoamnine oxidase A, which is in turn partly responsible for the catabolism of serotonin (5-HT) and norepinephrine (NE). Both animal and human studies point to a functional role for MAOA in impulsive aggressive behavior. On the one hand, it has been shown that MAOA knockout mice are hyperaggressive and have dramatically elevated 5-HT [64]. On the other hand, similar hyper-aggression and elevated levels of 5-HT have been found in humans who carry a single mutation of the MAOA gene. For instance, in Brunner's landmark MAOA studies in the early 1990 s, the males of a large Dutch family were found to be the human equivalents of MAOA knockout mice [65]. While female family members were asymptomatic, male family members were predisposed to aggressive outbursts, short tempers, and violent sexual behavior, stretching back several generations.

Bruner's pioneering work uncovered the first potential susceptibility gene for violent and anti-social behavior. While subsequent research has shown

[63] Through aversive conditioning, subjects learn to associate an unpleasant response—e.g., a mild shock—with an unwanted behavior which is supposed to discourage them from engaging in the behavior in the future.

[64] Passive avoidance involves the inhibition of a previously exhibited response. In passive avoidance, a subject may freeze as soon as the stimulus is presented. In active avoidance, on the other hand, the subject flees when the stimulus is presented.

[65] In differential reward-punishment tasks, sometimes subjects are exposed to both positive and negative reinforcement in response to the behavior under investigation.

that the MAOA knockout mutation Brunner identified is very rare, there is nevertheless a common polymorphism such that people can have relatively high MAOA expression (MAOA-H alleles) or relatively low MAOA expression (MAOA-L alleles) [66]. Moreover, while the MAOA-L allele does not directly confer an increased risk for violent behavior, the gathering evidence suggests that it nevertheless predisposes males who experience early life adversity or abuse to reactive violence and aggression.[66] In a recent review of the literature, Kim-Cohen et al. [71] found that "the association between early familial adversity and mental health [in males] was significantly stronger in the low-activity MAOA vs. the high-activity MAOA groups" (p. 903).[67]

Perhaps the most interesting work on MAOA for our present purposes involves what Buckholtz and Meyer-Lindenberg [77] call the "neural intermediate phenotype strategy" (p. 268)—i.e., the use of genetically-informed brain imaging to explore the relationship between MAOA and violence. By using functional and structural imaging in conjunction with information concerning MAOA-L, researchers have been able to examine the impact that this genetic variant has on brain structure, function, and connectivity of circuits in tasks such as inhibitory control, emotional memory, and affective arousal. Consider, for instance, the following findings:

1. Buckholtz and Meyer-Lindenberg [73] used both VBM and fMRI to explore the relationship between MAOA-L and inhibitory control. They found significant morphological differences in the limbic system (including cingulate gyrus, amygdala, hippocampus) in MAOA-L and a decrease in 8% grey matter volume. Moreover, they found highly significant genotype-related differences in brain functioning.
2. Alia-Klein et al. [78] used fMRI to explore the relationship between MAOA-L and the processing of emotional words. They found that MAOA-L subjects showed reduced left middle frontal gyrus activation relative to MAOA-H subjects in response to negatively valenced words. Moreover, MAOA-L subjects showed increased left amygdala and posterior thalamic activation than MAOA-H subjects in response to anger reactivity.
3. Meyer-Lindenberg et al. [79] used fMRI to explore the relationship between MAOA-L and reactive violence. They found pronounced limbic volume reductions and hyperresponsive amygdala during emotional arousal, with diminished reactivity of regulatory prefrontal regions, compared with the high expression allele. Moreover, in men, MAOA-L is associated with changes in orbitofrontal volume, amygdala and hippocampus hyperactivity during aversive recall, and impaired cingulate activation during cognitive inhibition.[68]

At this point, the mounting evidence suggests that the MAOA-L allele—in conjunction with certain environmental catalysts such as childhood abuse—confers a highly significant added risk in males for both antisocial behavior and reactive or impulsive violence. Of course, it remains to be seen whether our deepening understanding of the relationship between MAOA and violence in males will enable us to make better predictions concerning future violence. For now, we nevertheless believe that the exciting multimodal data being collected by researchers exploring the relationship between MAOA and violence serves as an illustrative example of what the future may hold when it comes to the feasibility of the neuroprediction of violence.

## Cutting-Edge Data Analysis: Pattern Classification

In addition to new methods of data collection, prediction of violence can be aided by new methods of data analysis. The most widely used approach for identifying potential neural substrates associated with violence or psychopathy is to compare either structural or functional brain scans in the target population with a reference group such as non-violent or non-psychopathic individuals. The approach is based on univariate statistics, where activity or structure in each location of the brain (referred to as a voxel) is compared across groups, one location at a time. This method is inherently weak for classifying individual people because the use of many individual tests can lead to many marginal differences between an individual and the reference groups, none of which are sufficient for classification. The approach can also lead

[66] See, e.g., [67–70].
[67] For other recent reviews of the MAOA literature, see [72–76].
[68] See, also, [80, 81].

to an increased risk of false classification simply by chance. Thus, this form of statistical analysis, while useful for examining how populations might differ in brain structure and function, is rarely sufficient for classifying individuals into one group or another.

An alternative approach is to use accumulated evidence from sets of voxels rather than single voxels. The joint information pooled across all the voxels is used to make a classification decision about whether the pattern in a given person looks more like what one might find, for example, in violent offenders or in non-violent offenders. Advances in both computer power and algorithms have facilitated the application of this new approach, generally referred to as pattern classification. When applied to brain scans it is called multi-voxel pattern analysis (MVPA). The MVPA approach has been used most successfully in the analysis of fMRI scans in an effort to perform mind-reading. Mind-readings studies involve scanning subjects while they are performing simple tasks such as looking at faces or houses on different trials. The goal is to develop a pattern classifier that can be "taught" to determine what a person is looking at just by analyzing ongoing brain activity.

Three steps are needed for MVPA to achieve this sort of classification [82]. First, the investigator needs to select features or locations in the brain that will be used by the classifier. For example, if the goal of the classification is to tell whether someone is looking at a face or car, then it makes sense to use functional information measured in the visual areas of the brain. Second, the functional information from the selected features is combined with the class membership (was it obtained while looking at a face or car) for the purposes of "training" the classifier. Knowing the actual classification, the algorithm is using the functional information sampled across the entire feature space and finding patterns of activity that are most effective at distinguishing activity that is present when looking at a face or a car. These distinguishing patterns can be thought of as templates. Third, new functional data from the same feature space (places in the brain) is compared to the templates built from the training data in step 2. Does the new test data look more like the template related to looking at a face or a car, and with what certainty? When done properly, MVPA is remarkably good at distinguishing between two functional patterns, such as faces and cars, with better than 80–90% certainty when the test set is based on many trials [83]. Efforts are now moving towards reliable classification of individual trials [84].[69]

The preceding example shows how the MVPA methods can perform simple mind reading based on fMRI. The same overall approach can be used to distinguish individuals within a group based on brain activity or to classify individual people into one group or another based on the brain data [86]. In this case, the training set, whether it is anatomic brain scans or fMRI activity, is drawn from a large sample of people coming from one group or another. The classifier algorithm creates the templates for the different groups. A new subject is then compared to the templates representing the different groups and a prediction is made about group membership.

While simple in concept, there are many technical challenges and potential pitfalls to be surmounted before this subject classification becomes widely used. Feature selection is a critical step in MVPA because adding in too much or too little information can impair the classifier performance. For the diagnosis of medical conditions by MVPA, this is not a huge problem, because much is already known about pathologic changes in the brain. Thus, it is straightforward to select features that would distinguish the disease from normal.

For example, in early Alzheimer's disease, the presence of brain atrophy in particular areas could be selected as features for the classifier [87, 88]. On the other hand, when distinguishing two groups that are defined only by behavioral differences, such as future risk of violent and non-violent behavior, it is not obvious what brain features should be used to train the classifier. One could use features defined historically from univariate methods. Alternatively there is ongoing research to develop new computational algorithms that identify an optimal set of features and simultaneously build a classifier to get around this problem. Of note, it is critical that the data used to test the predictive power of a classifier is different from the training data. Otherwise, the accuracy of the classification will be falsely elevated. Practically, this

[69] For instance, researchers were recently able to use a "functional connectivity index" to predict individual brain maturity in participants ranging from 7 to 30 years of age with just 5 min of resting-state fMRI data. The resultant "functional maturation curve" accounted for 55% of the sample variance [85].

means that it typically takes a very large sample of people to both build and then test for diagnostic accuracy. There are many classifier algorithms that trade off speed, power and accuracy. It is not yet clear which method works best for a given problem. Thus, the inability of a classifier to distinguish two groups can be due to the methods, rather than to a lack of neurobiological differences.

Conceptually, MVPA classifiers fall somewhere between clinical and actuarial assessment. The algorithms rely on large samples of supposedly representative subjects to build a model of group membership. In this sense, they are like actuarial methods and have similar potential problems of establishing that the selected groups used in the training step vary only along a relevant dimension (e.g., violence vs. non-violence) and not another (e.g., drug-use vs. non-drug use). They are like clinical judgment in the sense that the output of most classifiers is a "diagnosis." The person is or is not a violent risk offender. MVPA in this case is similar to psychiatric or clinical psychological examination. They are imperfect at making absolute predictions about complex behavior such as future violence and would likely benefit from complementary evidence. As an alternative to using MVPA in this narrow diagnostic sense, new computational methods are under development to build classifiers that operate along a continuum, rather than as split-deciders. For example, one recently developed classifier can predict a person's actual age within a few years, rather than simply predict if they are in a younger or older group based on an arbitrary age threshold [89]. This holds the potential for classifying a person in terms of a continuous metric of risk for future violence.

Classification of brain states or people based on imaging data is an area under exceptionally rapid technical evolution. Looking into the future, it is reasonable to predict that these methods will find an ever-increasing role in medical diagnostic applications. It remains to be determined whether this sort of information is additive or simply complementary to conventional methods used for prediction of violent crime. If pattern classification can be used to make better individualized predictions about violent offenders, it could help to address the image problem of actuarial assessment that we discussed in "Actuarial Risk Assessment and the Problem of Individualization". To the extent that neuroprediction incorporates information about the particular offender's brain, this may induce legal decision makers to be less cautious when it comes to actuarial predictions of violence. In short, we believe that recent advances in neuroscience such as genetically-informed imaging and pattern classification hold out the hope that 1 day we might be able to ensure that legal decision makers both have and utilize the best available scientific evidence possible.

## The Potential Promise of Neuroprediction

Now that we have examined (a) the legal relevance and importance violence risk assessment, and (b) some of the recent advances that have been made when it comes to our growing understanding of the neural correlates of violence, we want to briefly examine a study that we are presently undertaking that represents an important first step towards the possibility of developing new tools for the neuroprediction of violence. The primary goals of the study—which is being funded by the MacArthur Law and Neuroscience Project—are to replicate and extend existing risk-assessment studies by assessing risk factors at three time points (baseline, 6 months post-MRI and 1 year post-MRI), assess risk in incarcerated females and adolescents separately from incarcerated males, and add functional and structural neuroimaging variables to the risk equations. Our motivating hypothesis is that functional neuroimaging will lend incremental validity to the assessment of both criminal recidivism risk and relapse to substance abuse.[70]

Current conceptualizations of risk assessment are comprised of two types of risk factors: static factors and dynamic factors [91]. Static risk factors, such as criminal history and age at first conviction, are considered immutable and therefore, not amenable to intervention. Dynamic risk factors, such as substance abuse and criminal attitudes, are considered mutable and, therefore, represent rational targets for intervention [91]. A considerable amount of research has demonstrated that dynamic risk

[70] For the purposes of this paper, we are going to limit our attention to the neuroprediction of violence since discussing the neuroprediction of drug/alcohol relapse would take us too far afield. It is nevertheless worth pointing out that recent studies suggestion the latter is no less promising than the former. See, e.g., [90].

factors predict adult criminal recidivism [92, 93] and that structured risk assessment instruments outperform clinical judgment for the prediction of recidivism [94–98].

There are significant shortcomings related to the generality of these studies and their major findings that the proposed project seeks to address. The first is that extant literature has not yet integrated other potentially predictive forms of information (e.g., imaging data) that may provide unique predictive information, or evaluated the degree to which this type of information compares to established assessment approaches in predicting risk of recidivism. Also, the majority of these studies have assessed dynamic risk factors at a single time point, just prior to release, making it difficult to draw conclusions about how long-term changes in these variables impact recidivism. Thirdly, because most of the current risk assessment instruments have been developed in prisons and forensic hospitals, there has been an over-representation of adult males in their development and it is currently unclear whether these instruments provide acceptable levels of predictive accuracy in females and adolescents. Lastly, although structured risk assessment instruments outperform clinical judgment for the prediction of recidivism, recent studies found that the number of previous convictions predicted recidivism in women and men just as well as structured risk assessment instruments.[71]

Participants in our study will be incarcerated males, females, and adolescents (over 1300 total consented to date) who are currently enrolled in functional neuroimaging studies being conducted by Kent Kiehl and colleagues at representative prisons in North America. All inmates who have provided informed consent to allow follow-ups will be live contacted. Live contact (with interview) is considered the most robust way to accurately estimate relapse to drug use and/or criminal behavior. Participants will be reassessed at 6 months and/or 1 year post-participation in MRI scanning session. We will follow up inmates in prison and outside of prison. The former will permit collection of data regarding risk for institutional drug use and infractions, the latter will permit us to examine relapse to drug use and crime in the general community. Our overall target is to complete 300 follow-up visits.[72]

As things presently stand, we hope to be done collecting data by the end of 2011. In the meantime, the verdict will be out when it comes to whether recent advances in neuroimaging and data analysis can be used to make more accurate and reliable predictions of future dangerousness. We are moving forward with cautious optimism in the hopes that our present study will help set the stage for future research on the neuroprediction of violence. If the recent progress that has been made in neuroscience more generally is any guidance, we should not only be able to shed some important new light on the field of violence risk assessment but we may also be able to improve legal decision-makers' perception of predictions of future dangerousness. By adding important personalized information about the brains of offenders to the risk assessment equation, we may thereby make it more likely that legal decision makers rely on the best available tools of violence risk assessment. But before we can make any progress on the legal front, we must first make progress on the scientific front. In the meantime, we need to start setting the stage for future discussions about the neuroprediction of violence by considering what, if any, problems are likely to arise in the event that we are able to create new and powerful neuroscientific tools for predicting violence.

## The Potential Perils of Neuroprediction

In the last section, we discussed some of the details of our on-going prospective neuroprediction study. We believe recent advances both in violence risk assessment and in the neuroscience of violence give us grounds for cautious optimism when it comes to the potential promise of neuroprediction. However, whether this potential can be realized remains to be seen. For present purposes, we are simply going to assume for the sake of argument that in the not-so-distant future researchers will be able to use neuro-

[71] See, e.g., [23, 99–101].

[72] As things presently stand, Kiehl and colleagues are running a pilot study with only 300 follow-up visits. If hypotheses are confirmed, additional funds will be sought to follow up with all of the 1,300 participants who have already consented to participate.

science to improve the validity and reliability of predictions of future dangerousness. The question we now want to address is whether the use of neuroprediction could give rise to any unique evidentiary, constitutional, or moral problems above and beyond the problems that are associated with predictions of violence more generally. Since these latter concerns have already been addressed in the legal and philosophical literature, we will focus primarily on the *neuro* part of neuroprediction.

## Evidentiary Issues

One natural worry is that neuroprediction might violate some salient standard for the admissibility of evidence into trials. For instance, in order for expert evidence to be admissible, the early *Frye* test required only that "the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs."[73] However, in the landmark decision in *Daubert v. Merrell Dow Pharmaceuticals,* the U. S. Supreme Court held that in federal cases the Federal Rules of Evidence superseded the *Frye* test.[74]

More specifically, the Court held that federal judges have a duty to "ensure that any and all scientific testimony or evidence admitted is not only relevant, but *reliable.*"[75] The Court then provided a non-dispositive and non-exclusive[76] list of criteria to assist judges in making determinations concerning the reliability of scientific evidence:

1. Has the technique been subjected to falsification and refutation via experimentation?
2. Has the technique been subjected to peer review and publication?
3. What is the known or potential rate of error?
4. Has the technique been generally accepted within the relevant scientific community?

In addition to reliability, judges were also directed to consider any potential prejudicial impact of scientific evidence in trials. Writing for the majority, Justice Blackmun said:

> [Federal Rule of Evidence] 403 permits the exclusion of relevant evidence "if its probative value is substantially outweighed by the danger of unfair prejudice…or misleading the jury…" Judge Weinstein has explained: "Expert evidence can be both powerful and quite misleading because of the difficulty in evaluating it. Because of this risk, the judge in weighing possible prejudice against probative force under Rule 403…exercises more control over experts than over lay witnesses."[77]

This *Daubert* standard has been adopted by many states in addition to Federal courts.

Several judges and legal commentators have suggested that predictions of future dangerousness would technically fail each part of the *Daubert* standard for the reasons that we discussed earlier (see "Actuarial Risk Assessment and the Problem of Individualization").[78] In *Flores v. Johnson*,[79] for instance, Judge Garza concluded "that the use of psychiatric evidence to predict a murderer's 'future dangerousness' fails all five *Daubert* factors."[80] In contrast, other rulings admit predictions of violence post-*Daubert*. For instance, in *Nenno v. State*,[81] the Texas Court of Criminal Appeals addressed the admissibility of clinical predictions of future violence in the context of capital sentencing—finding that "[w]hen addressing fields of study aside from the hard sciences, such as the social sciences or fields that are based primarily upon experience and training as opposed to the scientific method, [the law's] requirement of reliability applies but with less rigor than to the hard sciences."

These two views can be reconciled simply by distinguishing determinations of guilt from sentencing. Even if predictions of violence fail the *Daubert* standards, those standards might apply in the guilt phase but not in the sentencing phase of a trial. Then predictions of violence could be excluded from the guilt phase of a trial (as in *Flores v. Johnson*) but not

[73] The *Frye* Test was based on a 1923 decision by the Court of Appeals for the District of Columbia concerning the admissibility of a crude precursor to the polygraph machine. See *Frye v. United States*, 54 App. D.C. 46, 47, 293 F.1013, 1014 (D.C. Cir. 1923).
[74] *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579 at 588-89 (1993).
[75] *Id.* at 589.
[76] *Id.* at 593.
[77] *Id.* at 595.
[78] See, e.g., [102–104].
[79] *Flores v. Johnson*, 210 F.3d 456 (5th Cir. 2000)
[80] *Id.* at 464.
[81] *Neno v. State*, 970 S.W.2d 549 (Tex. Crim. App. 1998).

from the sentencing phase of the trial (as allowed by *Nenno v. State* as well as *Barefoot*). This bifurcated standard comports with the general consensus amongst legal scholars that, even if predictions of violence run afoul of the *Daubert* standard, they will nevertheless continue to be admissible for the foreseeable future outside of guilt determinations.[82]

Although the future legal landscape is admittedly unclear, predictions of future dangerousness are currently admissible in multiple legal contexts ranging from capital sentencing and civil commitment to sexual predator statues (see "Violence Risk Assessment and Capital Sentencing", "Violence Risk Assessment and Civil Commitment", "Violence Risk Assessment and Sexual Predator Statutes"). Given that we are assuming for the sake of argument that neuropredictions of violence will one day be both more accurate and more reliable than their clinical counterparts, the former ought to raise even fewer evidentiary concerns than the latter. As such, if clinical predictions continue to satisfy evidentiary standards of admissibility, then neuropredictions are likely to pass muster as well.

However, there is one issue that could potentially arise in the context of neuroprediction that does not arise with respect to violence risk assessment more generally—namely, the potential prejudicial nature of neuroimaging data. As we saw earlier, one of the motivating concerns behind the decision in *Daubert* was the reliability standard that was built into the Federal Rules of Evidence (FRE). Consider, for instance, FRE 403:

> Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence.

According to FRE 403, it is not enough to establish that expert testimony is relevant, reliable, and legally probative. In addition, expert testimony should not be admitted if its probative value is shown to be substantially outweighed by its potential prejudicial impact on legal decision makers. In the case of neuroprediction, this concern may be especially salient given that some researchers have recently suggested that exposing people to neuroscientific evidence may have a tendency to unduly influence their intuitions and judgments.[83]

For instance, Weisberg et al. [108] exposed subjects to good and bad explanations with and without "neurobabble"— i.e., nonsensical or irrelevant brain information that consisted of purposely "circular restatements of the phenomenon, hence, not explanatory" (p. 471). Yet, despite the fact that the neurobabble added nothing explanatory, subjects nevertheless strongly favored the explanations that were supplemented with neurobabble. To the extent that neuroscientific evidence really does have a prejudicial effect, the state would need to take steps to ensure that legal decision makers do not confer greater weight to neuroprediction than the science warrants. But until we know more about how neuropredictions are likely to be interpreted and understood by judges and jurors, we will not be in a position to make informed decisions concerning whether (or when) neuroprediction ought to be used for the purposes of the law. Several researchers are already exploring precisely this issue. For instance, The MacArthur Law and Neuroscience Project is currently funding three studies that explore the potential prejudicial influence of neuroevidence (led by Michael Saks, Dena Gromet, and Thomas Nadelhoffer, respectively). The preliminary data suggest that legal decision makers may be better at navigating neuroscientific data than previous studies have suggested. So, at least for now, we believe it is an open empirical question whether neuroprediction is likely to be more prejudicial than it is probative.

Perhaps because of such uncertainties, when it comes to predictions of future dangerousness, courts tend to focus more on constitutional concerns than evidentiary concerns. Commentators have offered several explanations for this trend. On the one hand, the legal contexts within which these predictions are typically introduced do not afford defendants as many evidentiary protections. As Faigman et al. [105] point out, "Most courts either entirely ignore evidentiary

[82] See, e.g., [105–107].

[83] This is not to suggest that there are not any evidentiary worries about predictions of dangerousness more generally. However, for present purposes, we are less interested in the more general evidentiary worries about predictions of violence and more interested in exploring whether adding neuroscience to the violence risk assessment equation generates any additional concerns.

standards for expert testimony concerning future violence, or give it scant attention. A variety of explanations might account for this seeming oversight. Foremost, in many states, predictions of violence are offered in settings in which, explicitly and as a matter of statute, the rules of evidence are modified or suspended" (§10.2). On the other hand, because states have adopted statutory schemes whereby findings of future dangerousness are required by law, courts are perhaps understandably reluctant to erect evidentiary hurdles that frustrate the legislative will on this front. For instance, in *People v. Murtishaw* (1981),[84] the California Supreme Court observed that "in such cases expert prediction, unreliable though it may be, is often the only evidence available to assist the trier of fact." In short, because some statutes mandate predictions of dangerousness, judges are understandably reluctant to interpret the procedural rules of evidence that may frustrate the legislative will.

Monahan [106] makes the following remarks about the current state of play when it comes to the legal treatment of predictions of dangerousness in the wake of *Daubert*:

> [I]t could be argued that mental health professionals should not be allowed to testify as experts [on violence prediction] under the *Daubert* standard. However, (a) historically, the Supreme Court has been receptive to professional assessments of dangerousness; (b) in almost any case in which such assessments are made they will be based, at least in part, on validated risk factors (e.g., a history of violence); (c) mental health professionals could well make the point that they cannot validate their expertise in many circumstances without releasing dangerous individuals; (d) throughout our society, mental health professionals are expected by the law to make professional assessments of dangerousness when patients pose a serious risk of harm to others; (e) the Supreme Court also stated in *Daubert* that, still, "[w]idespread acceptance can be an important factor in ruling particular evidence admissible," and clinical assessments of dangerousness are widely accepted by the clinical community and increasingly by the academic community; and (f) if nothing else, it is likely that mental health professionals will be better able than laypersons to articulate, highlight, and analyze the factors that go into a dangerousness risk assessment. Given all this, it is highly unlike that the *Daubert* decision will affect the admissibility of professional assessments of dangerousness in federal courts or in states that follow the *Daubert* decision. (pp. 917-918)

In light of these observations, we believe that neuropredictions of violence are likely to be treated by the courts in much the same way as more traditional forms of violence risk assessment. So, unless future research firmly establishes that neuropredictions are markedly more prejudicial than they are probative, we do not foresee any unique evidentiary hurdles arising on this front. As such, we would now like to turn our attention to the potential constitutional issues that might arise when it comes to neuroprediction.

## Constitutional Issues

For present purposes, we will focus on possible federal constitutional limits on the legal use of neuroprediction, setting aside individual states' laws and federal statutes and regulations that might develop in the future. Moreover, since we have already seen that the Supreme Court has held that predictions per se do not run afoul of defendants' due process rights even in high stakes legal contexts ("Violence Risk Assessment and Capital Sentencing", "Violence Risk Assessment and Civil Commitment", "Violence Risk Assessment and Sexual Predator Statutes"), we are going to explore more narrowly whether the neuroimaging component of neuroprediction is likely to raise any unique constitutional concerns. Two provisions of the Bill of Rights to the U.S. Constitution might impose limitations: The Fourth Amendment forbids "unreasonable searches and seizures" and in many contexts requires the government to get a warrant before searching or seizing evidence. The Fifth Amendment guarantees the privilege against self-incrimination and has been interpreted to require *Miranda* warnings before custodial interrogation.

Because MRIs and fMRIs have not yet been tested in these contexts, one must try to extrapolate principles

[84] *People v. Murtishaw* (1981), 29 Cal. 3d 733, 175 Cal. Rptr. 738, 631 P.2d 446, 469 (1981).

developed to regulate other types of searches, medical procedures, and questioning, particularly analogous procedures such as psychiatric examinations and drunk-driving tests. What we say in this section, therefore, is an educated guess rather than a confident forecast of what courts will eventually permit. Ultimately, the law in this area is not developed enough to give convicts robust constitutional rights to refuse testing. Few Supreme Court cases address psychological testing of convicts in any context, and the Court has never addressed the possibility of brain imaging in the three legal contexts we have focused upon for the purposes of this paper—i.e., capital sentencing, civil commitment, and sexual predator hearings. That being said, we would now like to turn out attention to the Fourth and the Fifth Amendments.

*The Fourth Amendment*

The Fourth Amendment protects against unreasonable searches and seizures performed by the government or its agents.[85] Except where one of many exceptions applies, searches require either prior permission or a valid search warrant supported by probable cause to believe the item searched for is present. A person must have a reasonable expectation of privacy in the area that is searched in order to receive Fourth Amendment protection. A reasonable expectation of privacy is the kind of expectation that "society is prepared to recognize as 'reasonable.'"[86] That test is somewhat circular, but it depends in substantial part on social expectations. With emerging technologies, there may not yet be settled social expectations. "[A]t least where… the technology in question is not in general public use," the use of technology to penetrate "a constitutionally protected area" such as the home constitutes a search.[87] The home is explicitly listed in the Fourth Amendment as a constitutionally protected area, but one's own person is also listed and comes first, even before houses. Thus, at least until MRIs or fMRIs are in general public use by passers-by, their use will ordinarily constitute a search.

Even where a procedure counts as a search, there are many exceptions to the requirements of probable cause and a warrant. For one, as long as the searchee gives voluntary consent, a search does not violate the Fourth Amendment.[88] Thus, if anyone freely requests or gives permission to be scanned by MRI or fMRI, then scanning will not violate this provision of the Constitution. Another exception is that persons in government custody have reduced expectations of privacy in themselves and their surroundings. Thus, convicts detained in jail or mental hospitals pending sentencing will enjoy less Fourth Amendment protection than those who are free on bail. People who are confined inherently lose much if not all of their privacy. Those who have been convicted, sentenced, and imprisoned do not retain any Fourth Amendment rights in their prison cells.[89] Pretrial detainees may enjoy somewhat more protections, but even they can be strip searched without any justification and must suffer visual body cavity searches on less than probable cause.[90] After all, the traditional Fourth Amendment right to privacy is "fundamentally incompatible" with prison conditions, because society's interest in institutional security and order is "central to all other correctional goals" and must outweigh prisoners' expectations of privacy.[91]

[85] U.S. CONST. amend. IV ("The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized."); *United States v. Jacobsen*, 466 U.S. 109, 113 (1984) ("[Fourth Amendment] protection proscribes only governmental action; it is wholly inapplicable to a search or seizure, even an unreasonable one, effected by a private individual not acting as an agent of the government or with the participation or knowledge of any governmental official.").

[86] *Katz v. United States*, 389 U.S. 347, 351 (1967); *id.* at 360-61 (Harlan, J., concurring).

[87] *Kyllo v. United States*, 533 U.S. 1, 6-7 (2001) (internal quotation marks omitted).

[88] *Schneckloth v. Bustamonte*, 412 U.S. 218 (1973).

[89] *Hudson v. Palmer*, 468 U.S. 517, 526 (1983) ("The proscription against unreasonable searches and seizures under U.S. Const. amend. IV does not apply within the confines of the prison cell.").

[90] *Bell v. Wolfish*, 441 U.S. 520, 558-59 (1979). Lower courts are split on whether jailers need reasonable suspicion to conduct body-cavity searches of pretrial detainees or not.

[91] *Hudson*, 468 U.S. at 527-28. To determine whether a prisoner's expectation of privacy is reasonable, courts balance society's interest in prison security against the prisoner's interest in his own privacy. *Id.*

Prison regulations are constitutional if they are "reasonably related to [a] penological interest."[92] Courts show substantial deference to prison administrators' considerations and find many intrusive prison regulations reasonable and thus constitutional.[93] Not only are prisoners' cells freely searchable, but prisons can collect DNA samples, monitor prisoners' telephone calls, and mandate tests for HIV and drug use without showing probable cause.[94] Even parolees receive no constitutional protection against warrantless searches.[95] The trend of recent case law is to deny prisoners, and even parolees and pretrial detainees, all Fourth Amendment protection.

Nevertheless, this case law is probably distinguishable. Most of these cases involved convicts already sentenced and the need to keep order and serve the goals of punishment. Most involved searching cells or prisoners' persons for physical objects that could serve as weapons, contraband, or other forbidden items. Few if any of these cases appear to involve gathering evidence precisely for use at sentencing or parole, rather than to serve a prison objective. And none of them involved brain scans, psychological testing, or similar probes of the brain, which are in some ways much more intrusive and inessential for prison life. Thus, courts may well apply some Fourth Amendment protections to jailed convicts awaiting sentencing. It is quite possible, however, that future courts will extend these cases to deprive jailed convicts of all Fourth Amendment protection against brain scans or psychological tests. In that case, they would have to rely on the Fifth Amendment, which is a more natural fit for questioning.

Convicts who are not in custody but who are awaiting sentencing do not necessarily have diminished expectations of privacy, so courts are more likely to treat compelled brain scans and psychological tests as Fourth Amendment searches in this context. Being compelled to answer questions is usually addressed as a Fifth Amendment issue. Perhaps the closest the Court has come to addressing it as a Fourth Amendment issue was in *United States v. Dionisio*, where the Court held that subpoenas to testify before grand juries do not raise Fourth Amendment questions.[96] The *Dionisio* Court focused on the "civic duty" of citizens who testify before grand juries, which rationale would not apply to prisoners awaiting sentencing. One could read the opinion more broadly, however, as suggesting that as a rule, being compelled to answer questions does not implicate the Fourth Amendment. Judge Posner recently adopted this view in *Greenawalt v. Indiana Department of Corrections*. He worried that extending Fourth Amendment rights to mere questions could require search warrants for police interviews, prosecutors' cross-examinations, credit checks, and the like.[97]

Brain imaging, as distinct from psychological testing, might seem more like physical touching. Structural brain scans, to reveal the gross structures of the brain, certainly look like medical intrusions. Gathering physiological information by any means that involves physical touching is generally a search, even when the physical contact is minimal.[98] Drawing blood, administering a breathalyzer test, and taking a urine sample are all searches.[99] Like some of these procedures, fMRIs are noninvasive and are usually used to gather physiological data rather than probing for verbal answers.[100] Because this area of law has not yet been addressed, it is impossible to forecast with any certainty. The analogues suggest, however, that the Court would likely hold that a structural brain scan of a convict free on bail pending sentencing constitutes a search.

If psychological testing or a brain scan is a search subject to Fourth Amendment regulation, government

[92] *Turner v. Safley*, 482 U.S. 78, 89 (1987). Relevant factors in the reasonableness calculus are (1) whether the regulation is rationally connected to the legitimate governmental interest advanced to justify it; (2) whether prison inmates retain alternative means of exercising their right; (3) the impact of accommodating the right on guards and other inmates; and (4) whether there are ready alternatives to advance the government's interest. *Beard v. Banks*, 548 U.S. 521, 529 (2006).

[93] *Thornburgh v. Abbott*, 490 U.S. 401, 408 (1988).

[94] See *Sheffield v. Trevino*, 207 Fed. Appx. 403 (5th Cir. 2006) (DNA sample); *United States v. Balon*, 384 F.3d 38 (2d Cir. 2004) (prison telephone conversations); *Hunt v. Ortiz*, 84 Fed. Appx. 34 (10th Cir. 2003) (holding that mandatory HIV testing and disclosure of a prisoner's result is constitutional; prison's substantial interest in treating inmates infected with HIV and preventing further transmission outweighed prisoner's expectation of privacy).

[95] *Samson v. California*, 547 U.S. 843, 850-51 (2006).

[96] 410 U.S. 1, 10 (1973).

[97] 397 F.3d 587, 590-91 (7th Cir. 2005).

[98] *Greenawalt*, 397 F.3d at 589.

[99] *Schmerber v. California*, 384 U.S. 757, 766-67 (1966) (blood sample); *Skinner v. Railway Labor Executives' Ass'n*, 489 U.S. 602, 617 (1989) (breathalyzer); *Board of Education v. Earls*, 536 U.S. 822, 828 (2002) (urine testing).

[100] [109], 869; [110].

authorities can perform it so long as they obtain a warrant. Generally, search warrants require probable cause to believe that the search will reveal evidence relevant to a crime. But that standard can vary depending on the context. Surgical intrusions below the skin may require a higher degree of justification, balancing society's interests in the procedure against the individual's in privacy and security.[101] Psychological testing involves no medical intrusion, so probable cause would suffice. Brain scans involve non-surgical intrusions, so it is not clear whether a higher degree of justification would be required.

The probable cause standard does not quite fit either situation, however. Usually, the authorities are looking for evidence of a crime. For convicts awaiting sentencing, however, the crime has already been adjudicated. One could ask whether there is probable cause to believe that the intrusion will turn up information relevant to setting the appropriate sentence. But the justifications for punishment are so numerous, broad, and vague that almost any evidence about the defendant's character or psychology could be relevant, not just narrow historic information about the crime. In one sense, it is hard to point to individualized probable cause. In another sense, there is probable cause to believe that the brain of everyone awaiting sentencing contains information relevant to sentencing, at least if the tests are sophisticated enough. The probable cause standard simply does not fit very well.

Courts might then decide to focus not on probable cause but on reasonableness. However, there are few pre-existing expectations with a new technology and, thus, no basis for predicting what courts will consider reasonable. They could focus either on brain scans' lack of physical intrusion (making them reasonable) or on their non-physical intrusiveness (which could make them unreasonable, absent some special, individualized justification). In short, courts may well routinely rubber-stamp boilerplate warrants, instead of insisting on a particular showing of an organic brain injury, psychopathy, or similar gross feature that is suspected to be present. Forecasting is again difficult here, because this context is so radically different. But our sense is that meaningful protection is less likely to come from the Fourth Amendment than from the Fifth Amendment—which is the topic of the following section.

[101] *Winston v. Lee*, 470 U.S. 753, 760 (1985).

*The Fifth Amendment*

The more natural limitation on psychological tests and brain scans appears to come from the Fifth Amendment. The Fifth Amendment forbids compelling any person in a criminal case to be a witness against himself.[102] It applies not only to the guilt phase (such as a jury trial) but to criminal sentencing as well.[103] In *Estelle v. Smith*, for instance, the Court held that the government could not interview a prisoner before sentencing without warning him that he had the right to remain silent. The Court treated the psychiatrist like any other agent of the state using the fruits of custodial questioning. If a criminal defendant neither initiates a psychiatric evaluation nor tries to introduce psychiatric evidence, the Court held, the state cannot force him to speak to a psychiatrist if his statements can be used against him in capital sentencing. The state can use an evaluation for the limited purpose of assuring that the defendant is competent to stand trial, but not more generally at sentencing.[104]

One cannot be sure how far *Estelle*'s holding will extend to different factual settings. The Court left open whether its holding would extend to all other kinds of sentencing interviews and examinations.[105] A later case, *Penry v. Johnson*, rejected a Fifth Amendment challenge to using a psychiatric report that referred to the defendant's future dangerousness at his capital sentencing hearing. *Penry* suggested that *Estelle* was limited to its precise facts and had never been extended beyond them.[106] As such, it is presently unclear whether *Estelle* applies to non-capital sentencing. On the one hand, courts often treat death as different and deserving of heightened procedural protections, and *Penry* indicates a desire to limit *Estelle*. On the other hand, its reasoning appears to be equally applicable to all sentencing proceedings. Most lower courts have read *Estelle* as allowing compulsory psychiatric examinations if the defendant offers his own psychiatric evidence or defense. They

[102] U.S. CONST. amend. V.
[103] *Estelle v. Smith*, 451 U.S. 454, 462-63 (1981).
[104] *Id.* at 465-68.
[105] *Id.* at 468.
[106] 532 U.S. 782, 795 (2001).

treat such claims as waivers of the defendant's Fifth Amendment privilege.[107] This rule could also apply to brain scans, especially where a defendant chooses to undergo an examination or scan for his defense, but no case has ever addressed this situation.

It is worth noting that *Miranda* warnings are required only when a suspect is both in custody and is being interrogated. Interrogation covers only those questions that seek testimonial incriminating responses. Thus, for instance, routine booking questions about a suspect's name, age, date of birth, address, and the like do not trigger *Miranda*'s protections because the government does not seek to use the answers for the truth of the matters asserted. Even using the defendant's manner of response, such as his slurred speech, against him, does not amount to using his testimony to incriminate himself.[108] Routine booking questions are not "reasonably likely to elicit an incriminating response."[109] Even if a suspect blurts out something incriminating in response, or the police use the suspect's address to generate incriminating leads, the government is not compelling incriminating testimony. But if the government uses a question to probe the defendant's thought processes, by for example requiring him to compute the date of his sixth birthday when he may be intoxicated, that question counts as compelled interrogation.[110]

These distinctions suggest that structural and functional brain scans are distinguishable from lie-detector brain scans or psychological tests. The former reveal gross neurological impairments and general brain functions without depending on the truth value of any of the defendant's thoughts or assertions. The latter's value depends on the way a defendant thinks about and responds to questions. Structural and functional brain scans do not depend on the meaning of answers to questions; lie-detector scans and psychological tests do. Thus, if a convict tries to introduce psychiatric evidence, or perhaps even related claims such as lack of future dangerousness, the state may compel the defendant to undergo a brain scan or psychiatric examination by a state psychiatrist. If not, *Estelle*'s holding suggests that the Fifth Amendment would require reading *Miranda* warnings and allowing the defendant to stay silent without penalty. Structural and functional brain scans could be conducted without any questioning related to the crime, but not lie-detector scans or psychological tests.

As we have seen, the law on this front is presently too underdeveloped for us to do more than speculate. As brain imaging becomes increasingly more common—both in forensic and non-forensic settings—the legal treatment of neuroscientific data may change. As things presently stand, we believe that neuropredictions of violence—assuming they are shown to be more reliable than they are prejudicial (see "Evidentiary Issues")—are unlikely to raise any serious constitutional concerns. So, while defendants may be granted some Fourth and Fifth Amendment protections on this front, the scope of these protections will depend not only on the legal context but also on the specific types of brain scans used.

## Moral Issues

In addition to the legal issues we just discussed, neuropredictions of violence could potentially raise several moral issues. However, it is worth pointing out from the start that neuroprediction could also allay other concerns. For instance, as we saw earlier in §2.2, some commentators think that actuarial predictions of future dangerousness are morally problematic since they incorporate non-individualized factors into the violence risk equation. On this view, an offender's sentence or commitment ought to be based solely on unique features of the offender rather than aggregate data about the groups to which the offender belongs. Given that neuroprediction would help allay this concern by including individualized information about the brains of offenders, we do not think this objection—however misplaced it may otherwise be for the reasons we have already discussed—is one that applies in the context of neuroprediction. Indeed, if anything, neuroprediction should be welcomed by the critics of actuarial prediction.

The issue we now want to address is whether there are any moral issues that might uniquely arise when neuroscience is used for violence risk assessment. Consider, for instance, the most common objection to using predictions of future dangerousness for the purposes of sentencing—namely, that these predictions are irrelevant when it comes to what offenders

[107] See, e.g., *Pope v. United States*, 372 F.2d 710, 720-71 (8th Cir. 1967). See also Slobogin et al. [111].
[108] *Pennsylvania v. Muniz*, 496 U.S. 582, 590-92, 601 (1990).
[109] *Rhode Island v. Innis*, 446 U.S. 291, 301 (1980).
[110] *Muniz*, 496 U.S. at 598-99.

deserve. On this purely retributive view, the goal of punishment is dispensing desert—i.e., making the blameworthy suffer proportionally for their wrongdoing. From the standpoint of retribution, allowing violence risk assessment to enter the sentencing equation inevitably leads to unjust punishment. On the one hand, predictions of dangerousness could be used to give culpable but no longer dangerous offenders lighter sentences than they supposedly deserve. On the other hand, these predictions could be used to give admittedly dangerous offenders harsher sentences than they supposedly deserve. Either way, to the extent that predictions of future dangerousness are inherently forward looking, they fail to track what retributivists take to be the only salient grounds for punishing—namely, blameworthiness. [112] succinctly summarizes this retributivist worry in the following way, "Blame attaches to what a person has done. Past criminal behavior is the only scientifically valid risk factor for violence that unambiguously implicates blameworthiness, and therefore the only one that should enter the jurisprudential calculus in criminal sentencing" (p. 428).[111]

On our view, now is neither the time nor the place for us to take sides when it comes to the well worn debate between retributivists and their consequentialist opponents. For present purposes, the important point is that regardless of one's theory of punishment, the neuro part of neuroprediction doesn't seem to create any additional problems above and beyond those associated with predictions of future dangerousness more generally. If one is morally opposed to using violence risk assessment for the purposes of sentencing, then one will quite naturally be opposed to neuroprediction. If, on the other hand, one is supportive of using violence risk assessment for the purposes of sentencing, then one ought to welcome neuroprediction insofar as it lends incremental validity to existing actuarial models. But in either case, the neuro component is not doing any additional argumentative work.

The same can be said about other worries that might arise in the context of neuroprediction. Imagine, for instance, that we could use genetically informed neuroprediction to identify psychopathic individuals as early as 6–8 years of age (or even younger). Who should have the authority to collect or access this potentially stigmatizing data? Should the parents alone have the right to have their children tested or should public officials have the ability as well under certain circumstances—e.g., young children with very serious behavior problems? What, if anything, should the state be able to do in the event that it has discovered that a young child is in the highest category of risk? Can we force these children to undergo behavioral therapy? Can we forcibly remove these children from their homes and institutionalize them in the event therapy is ineffective? If we were to develop pharmacological therapies for psychopathy, for instance, would the state be justified in forcibly medicating pre-psychopathic children who will otherwise likely go on to injure or kill innocent members of society?

These are just a few of the kinds of deep and complex moral issues that may arise on the horizon as our tools for predicting violence become increasingly more powerful. However, as was the case with the aforementioned worries about both individualization and retribution, these moral questions and issues are not unique to neuroprediction. After all, the same problems would arise if non-neural actuarial models became increasingly powerful—which is characteristic of nearly all of the imaginable contexts where neuroprediction might be thought to generate moral concerns. Most of these worries seem to be driven by the prediction element of neuroprediction rather than the neuro element.

Consider, for instance, the following potentially negative side effects that could result from utilizing increasingly more powerful methods of neuroprediction. First, as the science underlying neuroprediction improves, legal decision makers could become too comfortable with the role that prediction plays in the law more generally. In the case of capital sentencing or sexual predator statutes, neuropredictive tools could engender an unwarranted complacency on the part of judges and jurors when it comes to the potentially problematic role played by prediction in these high stakes contexts. Moreover, as legal decision makers become increasingly comfortable with relying on neuropredictions of violence, they may be tempted to utilize these predictions in legal contexts within which predictions normally do not, and arguably should not, play a role—e.g., the guilt phase of criminal trials or non-capital sentencing. Consequently, the potential overreliance on neuroprediction could crowd out other traditional goals of

[111] See, also, [113, 114].

the criminal justice system such as giving offenders what they deserve.

Whether one is bothered by this cluster of related potential side effects of neuroprediction will of course depend on one's views concerning the proper relationship among retribution, prevention, rehabilitation, and the like—which is an issue we have already set aside for the purposes of this paper. It is nevertheless worth pointing out that these side effects are not unique to neuroprediction. After all, what's really driving the worry is the increased predictive power of cutting edge tools for violence risk assessment. If new non-neural actuarial tools were developed that were every bit as powerful as the neuropredictive tools we are envisioning, the worries about overreliance and the false sense of complacency would arise all the same. So, here again, the issues raised on this front are really driven by prediction more generally rather than neuroprediction specifically.

That being said, it is certainly possible that the neuro element of neuroprediction might be especially likely to tempt legal decision makers to place more stock in prediction than they should. As we saw earlier, legal decision makers are not especially fond of actuarial assessment ("Actuarial Risk Assessment and the Problem of Individualization") and there is at least some evidence that neuroscience could have a prejudicial effect on people's intuitions and judgments ("Evidentiary Issues"). So, it is certainly possible that increasingly powerful methods of neuroprediction may have a greater impact on legal decision makers than similarly powerful actuarial models. For the sake the argument, let's assume that turns out to be the case. Either the legal decision makers are placing more stock in neuroprediction than the science merits—in which case, neuroprediction may not be admissible based on the evidentiary issues we addressed earlier in "Evidentiary Issues"—or legal decision makers end up correctly trusting the science behind neuroprediction. Whether neuroprediction is likely to have either of these two competing effects on legal decision making is a straightforward empirical matter. If it turns out that the neuro element of neuroprediction is unduly prejudicial, there are already rules in place to keep it out of the courtroom. If, on the other hand, neuroprediction makes it more likely that legal decision makers will rely on the best available scientific evidence when they are asked to consider predictions of future dangerousness, then all parties to the debate about prediction ought to welcome this development, all other things being equal.

While one may ultimately reject the use of neuroprediction for the purposes of the law on moral grounds—especially in high stakes contexts such as capital sentencing and civil commitment—it would likely be on the grounds that it involves prediction more generally, not because it incorporates neuroscientific data. Fully addressing the more general worries about prediction would take us too far afield. For present purposes, we conclude that so long as neuroscience can be used to make more accurate and reliable predictions, these predictions will likely be less morally problematic than the predictions already being used by legal decision makers. Consequently, unless and until some presently unforeseen moral issues arise in light of future developments in neuroprediction, we believe the moral debate about the proper relationship between violence risk assessment and the law ought to focus on the problems associated with prediction rather than focusing on the potential use of neuroscience for predictive purposes.

## Conclusion

We have seen that neuroprediction of violence is controversial and potentially problematic but still promising. Opponents raise various objections, but none seems conclusive. Neuroprediction of violence does not conflict with current practices, since other forms of violence prediction are already used in other legal arenas, including capital sentencing, civil commitment, and post-punishment detention of some sexually violent predators. Violence predictions can do tremendous harm when mistaken, but all that shows is that the legal system should use the best possible methods when it relies on these predictions. As we saw, clinical predictions are usually less reliable than actuarial predictions, and there is some reason to hope that neuroscience might improve the accuracy of actuarial predictions. Moreover, we found no novel legal or moral issues that were raised by neuroprediction that were either not already raised by other forms of violence prediction or that would not be easily remedied. If this is correct, then neuropredictive methods are worth developing and then using in some areas of the law so long as legal

decision makers do not place more stock in neuro-predictions than they should.

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