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Defining A Neurocompatibility Index for Criminal Justice Systems: A Framework to Align Social Policy with Modern Brain Science

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Criminal jurisprudence is often driven more by intuition and political needs than by evidence-based science. As a result, criminal laws frequently prove sub-optimal and inefficacious. As a guideline for improvement, we here define a neurocompatibility index: seven criteria to measure the degree to which a system of criminal justice is compatible with the lessons of modern science. These include: (1) understanding of mental illness, (2) methods of rehabilitation, (3) individualised sentencing based on risk assessment, (4) eyewitness identification standards, (5) specialised court systems, (6) incentive structuring based on psychology, and (7) a minimum standard of science education for policy-makers. As demonstrated in the ideas outlined here, a brain-compatible system prizes fairness and long-term crime prevention over harsh yet inconsequential punishment.

1. Introduction

While systems of criminal law have traditionally rested on intuitions about blameworthiness and punishment, the resulting policies sometimes result in low efficacy and high cost. Jails have become a prime recruitment point for gangs, and long prison sentences often leave the newly released with little ability to re-enter as productive members of society. These factors, along with many others associated with current norms in criminal justice, lead to high recidivism rates and increasingly high social and monetary costs to the communities in which they operate.

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To improve this situation, criminal justice systems could draw great benefit from a deeper engagement with the lessons of modern science. In a biologically-informed, evidence-based system of law, criminals would continue to be taken off the streets – but with customised sentencing, new opportunities for rehabilitation, and more realistic incentives for pro-social behaviour. Alignment with the lessons of brain science suggests a new way forward for law and order – one that will lead to a more cost-effective, humane, and flexible system, benefiting both the convicted and the communities into which they are eventually released.

A basic starting point – one that is obvious in biology but not usually broached in legal or political circles – is the fact that individual brains are quite different. Along any axis we measure such as aggression, empathy, impulse-control, capacity to simulate possible futures, and risk aversion, we find that brains are distributed along a spectrum. While it is charitable to imagine that all adults possess the same capacity to make sound choices, it is a demonstrably incorrect assumption. In truth, brains are as individualised as fingerprints. We are each constructed from a genetic blueprint, and then born into a world of circumstances that we cannot control in our most formative years. The complex intertwining of genes and environment means that all citizens – equal before the law – possess different perspectives, varied personalities, and dissimilar styles of decision-making.

By allowing criminal laws to account for the deeply embedded neural programmes that steer our perceptions and behaviours, we can imagine a transition from blameworthiness to biology. This is because the assignment of blameworthiness demands the impossible task of untangling the hopelessly complex web of genetics and environment that constructs the trajectory of a human life. In place of this, we suggest that the assignment of blameworthiness is sometimes less important and should be subsumed by the larger assessment of what to do, moving forward. How likely are criminal actions to be repeated? Can this person be helped towards pro-social behaviour? How can incentives be realistically structured to deter crime?

There is no reason why social policy should not be designed as rigorously as any science experiment, leveraging a dispassionate view of the available data to optimise the utility of our money and efforts. The price of ignoring the science is over- and under-inclusive prison systems at high social costs to the larger communities they are designed to serve. Not all

crime can be prevented, but when it happens, the perpetrators can be treated in a way that maximises their chance for re-integration into society instead of a process of enduring exclusion.

Before diving into the main argument, it is crucial to clarify one point: an improved biological understanding of human behaviour will not exculpate anyone; we will still remove from the streets lawbreakers who prove unable to conform their behaviours to the societal norms. In other words, an evidence-based system will not lead to excuses for anti-social behaviour or remove all the retributive elements that underlie criminal justice systems. It will instead place ideas of punishment and retribution in their larger biological context, improving the customisation with which we can respond to the vast range of criminal acts.

In the following section we will outline a neurocompatibility index. This measure comprises seven criteria to quantify how well a system of criminal law is compatible with the lessons of modern science. Measured against this neurocompatibility index, most countries in the world today fall short of a satisfactory score. Our future work will seek to rank all nations on this index.

2. A Neurocompatibility Index for Systems of Criminal Law around the World

2.1. Understanding Mental Illness

A criminal justice system informed by neuroscience will allow us to move beyond treating prison as a one-size-fits-all solution. To be clear, the authors of this paper are not opposed to incarceration. For many people, it provides both warehousing and future deterrence, to themselves and others. In some sense, prison is the original rewire-the-brain rehabilitation strategy.

But behavioural adjustment based on this sort of punishment works only for individuals whose brains are functioning in such a way as to appreciate the nature of the punishment as an effect of their actions. For those with various kinds of mental illnesses, exacting punishment has no utility because there is no way to tie it to their actions. Their brains are incapable of modifying accordingly.

Unfortunately, in many countries prisons have become *de facto* mental health care facilities. In America, for example, current estimates place the percentage of mentally ill at 35 per cent. This staggering number

leads to an enormous strain on a prison system that has little to no hope of serving any kind of deterrence role in their future behaviour.

Despite recognition of mental illnesses going back to the Romans and Greeks, all modern societies have struggled with how best to deal with those guilty of a criminal act but unable to appreciate the consequences of their actions or conform those actions to societal norms. Many western countries still use an insanity defence that dates back to the mid-19th century. At the same time, studies have shown that of the less than one per cent of defendants who plead insanity in the United States, fewer than one in four are successful, and of those that are, 90 per cent have been previously diagnosed with a mental illness.

In large part, the United States' struggle to define mental illness in the 20th century highlights the difficulty inherent in this question, but also the need for such standards. And it exemplifies the need for all societies to understand mental illness, its causes, and what can be done to treat it or control its effects to be able to promulgate effective rules and standards in criminal proceedings. This translates into a need for the de-stigmatisation of mental illness and, resultingly, a meaningful insanity defence in every jurisdiction in the world.

A better understanding of mental illness comes with improved rehabilitative strategies for dealing with it, which leads to our next prong.

2.2. Methods of Rehabilitation

Worldwide, the most common method of dealing with law breakers appears to be incarceration. Beyond its physical costs, however, incarceration also comes with social consequences. First, it breaks an individual's social circles and employment opportunities. Especially for young people, the collateral consequences of jail time include an inability to earn a college grant, or, more generally, to optimise a career trajectory. Second, it introduces the incarcerated to prison social norms and social circles that are at odds with the interests of their community and often lead to drug use and gang membership both during a prison term and after.

A neurocompatible criminal justice system translates biological understanding into customised rehabilitation, viewing some aspects of criminal behaviour the way we understand conditions such as epilepsy, schizophrenia, and depression.

Although rehabilitation was previously seen as too expensive and politically unpalatable, many people now recognise the long-term cost effectiveness of rehabilitating offenders instead of packing them into overcrowded prisons. In California, for example, the prison system was required to release 30,000 inmates due to overcrowding, many of whom were incarcerated for non-violent drug offences. Without drug treatment, the chances of recidivism for these inmates are high and will create a negative feedback loop both for the prisoners and the taxpayers. But the challenge in this area has been the dearth of new ideas about how to rehabilitate.

A better understanding of the brain offers new ideas. For example, consider the fact that poor impulse control is a hallmark characteristic of the majority of those locked in the prison system. Whether as a result of anger or temptation, their actions override reasoned consideration of the future.

If it seems difficult to empathise with people who have poor impulse control, just think of all the things we all succumb to against our better judgement. Another martini? Late night pints of ice cream? Reality TV? It is not that individuals do not know what is best for them; it is simply that the frontal lobe circuits representing long-term considerations do not always win elections against short-term desire when temptation is present.

This line of reasoning suggests new strategies for rehabilitation to allow an individual to have better control of his behaviour, even in the absence of external authority. With Steven LaConte at Virginia Tech, we are developing a new approach, one that springs from the understanding that the brain operates like a team of rivals: a competition among different neural populations to control the single output channel of behaviour. Because it is a competition, the outcome can be tipped.

The basic approach is to give the frontal lobes practice in squelching the short-term circuits. To this end, we have begun leveraging real-time feedback to participants during brain imaging. This technique allows them to see when their brain is craving, and to learn how to control (in this case, to lower) that neural activity by strengthening other, long-term decision-making mechanisms. The approach leaves the brain intact – no drugs or surgery – and uses the natural mechanisms of brain plasticity to help the brain help itself. After training for better impulse control, a per-

son may still crave cigarettes (or cocaine or someone else's wallet), but he will know how to win over the craving instead of letting it win over him.

This science of this 'frontal lobe workout' is at its very earliest stages, but we have hope that the approach represents the correct model: it is simultaneously well grounded in biology and libertarian ethics, allowing a person to help himself to better long-term decision-making.

At its most basic level, effective treatment options would help those who want to help themselves. Whether for those already in prison or for preventative treatment with individuals who are aware that they are at risk of anti-social behaviours, effective treatment methods offer people an opportunity to stay out of the system – a sort of voluntary preventative medicine that would reduce the burden placed on prisons and improve economic development in neighbourhoods devastated by drugs and drug-related crimes.

2.3. Individualised Sentencing Based on Risk Assessment

A neurocompatible criminal justice system provides for individual risk assessment. While no system should treat similarly situated individuals differently, neither should a fair system fail to account for the differences.

The common law in Western countries is already forward-looking in some respects. For example, it has long been the case that crimes of passion (for example, reacting violently when catching a spouse's lover) are subject to lower penalties than a premeditated murder. Those who commit the former are less likely to recidivate than those who commit the latter, and their sentences sensibly reflect that. Likewise, most systems of law draw a bright line between criminal acts committed by minors and those by adults, punishing the latter more harshly. This approach has low resolution, but the intuition behind it is sound: adolescents command different skills in decision-making and impulse control than do adults. It is appropriate to give lighter sentences to those whose impulse control is likely to improve naturally as adolescence gives way to adulthood.

Taking a more scientific approach to sentencing, case by case, could move us beyond these limited examples. Consider the important changes that are happening in the sentencing of sex offenders. Several years ago, American researchers began to ask psychiatrists and parole board members how likely it was that individual sex offenders would relapse when let out of prison. Both the psychiatrists and the parole board

members had experience with the offenders in question, as well as with hundreds before them – so predicting who would go straight and who would come back was not difficult.

Or was it? The surprise outcome was that their guesses showed almost no correlation with the actual outcomes. The psychiatrists and parole board members had the same predictive accuracy as coin-flipping. This result astounded the research community, especially given the expectation of well-refined intuitions among those who work directly with offenders.

So researchers next tried a more actuarial approach. They set about measuring dozens of factors from 22,500 sex offenders who were about to be released. At the end of the study, they computed which factors best explained the reoffence rates, and from those data they were able to build actuarial tables to be used in sentencing.

As it turned out, when one compared the predictive power of the actuarial approach to that of the parole boards and psychiatrists, there was no contest: numbers won over intuitions to an astounding degree. In many courtrooms, these actuarial tests are now used in pre-sentencing to modulate the length of prison terms based on the risk offenders pose once released.

It will always be impossible to know with certainty what someone will do upon release from prison – a person's brain and experiences will never be fully quantifiable. But more predictive power is hidden in the numbers than people customarily expect. Statistically-based sentencing will be imperfect, but it nonetheless allows evidence to win over folk-intuition, and it offers customisation in place of blunt guidelines.

2.4. Eyewitness Identification Standards

A neurocompatible criminal justice system follows the foundational principle that the protection of the innocent trumps the prosecution of the guilty. No one is served when innocent defendants are convicted – not only is a productive member of society removed, but the guilty member is enabled to reoffend.

Television and popular culture tell us that DNA and fingerprints are used in nearly every case to ensure the conviction of the guilty. But in many cases eyewitness testimony is used as the main evidence against the defendant. This type of evidence is often persuasive because jurors, just

like the witness, believe that their memories are like movies or photographs that can be recalled as objective truth.

In reality, memory can be highly unreliable, and eyewitness testimony is often plagued with errors. A victim is likely to be focused on the weapon being used against them and heavily affected by stress. The Innocence Project, an American organisation which uses DNA evidence to overturn wrongful convictions, reports that 73 per cent of their wrongful convictions were the result of mistaken eyewitness testimony and, of those, a third rested on the testimony of more than one mistaken eyewitness.

More needs to be done to curb the failures inherent in this type of evidence. While eyewitness testimony can never be eliminated from criminal proceedings, three decades of cognitive science literature suggest safeguards that can be put in place to ensure that these identifications are unbiased and put in their proper context during investigations and trials.

Several studies have confirmed a number of reforms that would drastically improve the reliability of eyewitness line-ups. For example, the police may give unconscious cues to a witness when reviewing a line-up. It has been shown that when the police officer administering the line-up is also not aware of who the suspect is, the rate of incorrect identification drops significantly.

New technologies will also continue to offer opportunities for improvement – for example, using iPads to display suspects' photos at the scene of a crime, before memory has moved too far along the forgetting curve.

2.5. Specialised Court Systems

Because some crimes are the result of inherently different impulses from others, a neurocompatible criminal justice system utilises specialised court systems that embed expertise with issues ranging from mental illness, drug addiction, and juvenile decision-making. By separating the courts in which these crimes are tried, the judges and lawyers involved are better able to address the specific needs of their communities and those on trial.

In many countries, family courts are already separated from other civil proceedings because of the level of expertise and uniqueness involved with divorce and child custody issues. The same is often true for

purely statutory violations such as speeding or expired registration stickers. And yet, most criminal courts may only distinguish between felony and misdemeanour cases, meaning that the same judge tries murder and copyright violations. Relatedly, while some district attorneys' offices assign prosecutors to a specific division of crime, many do not – and the same prosecutor who tried a 17-year old gang member the week before may try a 50-year old paedophile the next.

By being forced to become repeat players in specific areas, judges and lawyers are more likely to understand that the intersection of an individual's motivations and capacities allows more refined treatment options, presumably with better societal and financial outcomes. After all, the same crime can be committed by very different brains for very different reasons.

Collectively, specialised court systems provide people with an opportunity to receive more informed sentencing, counselling, and rehabilitation, thereby enhancing their chances of staying out of the prison system.

2.6. Incentive Structuring

A neurocompatible criminal justice system is interested in tailoring incentives to have the greatest positive impact on behaviour. With a better biological understanding of how people actually behave (as opposed to general models of how they are hypothesised to behave, or should behave), there are several opportunities to optimise approaches in social policy.

To give one example, it has become clear that brains are more like a parliament of competing interests than a unitary executive version of the self. Just as in any parliament, some parties are prone to short-term decision-making while others are invested in the long term. These parties battle it out before reaching a decision, and we often find that the short-term party wins out more often in people that commit crimes.

As a result, people often appreciate the negative long-term consequences of their decision-making (prison), but find the impulses (wanting someone else's money) winning out nonetheless. In this light, one way to leverage this understanding is to build the incentive structure of a given penal system to help the long-term party win the day.

One approach, advocated by the policy scholar Mark Kleiman, is to ramp up the certainty and swiftness of punishment. For example, a drug

offender may be required to submit to three-times-a-week drug testing and, if the test is failed, the offender is automatically sanctioned rather than simply facing the possibility of a future court date that would eventually lead to an uncertain sanction down the road. A similar program, Hawaii's Opportunity Probation with Enforcement, has led to a drop in rearrest rates from 47 per cent to 21 per cent. By this same logic, economists have suggested that the drop in crime since the 1980s has been due, in part, to the increased presence of police on the streets: their mere presence shores up support for the parts of the brain that consider long-term consequences.

There are innumerable ways to tailor incentives to match our current understanding of the biological processes in the brain. A neurocompatible criminal justice system would find ways to decrease crime and recidivism by creating probation and parole systems that work with, rather than against, the decision methods offenders employ.

2.7. A Minimum Standard of Science Education for Policy-Makers

Nearly every state in America requires lawyers to spend some number of hours (usually around 15 a year) educating themselves on developments within the legal system. A neurocompatible criminal justice system would have a similar requirement for science education for judges, lawyers, lawmakers, and parole officers who practise in this field.

Those involved in the day-to-day workings of our criminal justice systems should neither ignore nor exaggerate the relevant science. Just as the public once had to be educated on DNA evidence, parole boards should be equally aware of the social science relating to recidivism. At the same time, it is equally important for these repeat players to be told what science is not capable of telling us – for example, the idea that genetics would ever be able to tell us anything detailed about individual behaviour.

Changing the opinions and knowledge base of those involved in writing and executing our criminal laws is crucial to the full integration of successful treatment and sentencing options into the courts.

3. Conclusion

We have outlined a series of recommendations by which a criminal justice system could become more neurocompatible – that is, aligned with current knowledge about human brain science and psychology.

Fundamentally, many issues relating to criminal justice systems around the world fall within the domain – or at least the penumbra – of a more refined understanding of human behaviour. A forward-thinking legal system informed by scientific insights into the brain will enable us to move beyond treating prison as a one-size-fits-all solution. From tailored sentencing to customised rehabilitation, these recommendations will allow a community to remove and isolate criminal behaviour while increasing the likelihood that those released from prison will return as productive and pro-social assets to the communities they are re-entering.

It should also be clear that today no country would score perfectly on the neurocompatibility index. Every criminal system has some distance to go before any can be said to be fully in line with modern knowledge about human behaviour and crime. The index here, however, can be viewed as 'best practice' standards based on a modern view of neurolaw. In other words, this neurocompatibility index sets up a series of guidelines by which governments and policy-makers can consider the inclusion of modern science into their criminal justice systems.

Finally, the issues outlined here mean that the lawyers and judges of the future will be handed a very different set of tools before entering their field. In addition to their current studies of legal history and concepts, these future practitioners will also possess a bedrock understanding of science, mental illness, eyewitness identification, opportunities for rehabilitation, and realistic ideas of how our brains process both the good and bad decisions each of us is faced with on a daily basis.

4. Sources and Further Reading

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