IMPLICATIONS OF NEUROSCIENCE ON CRIMINAL LAW

By Ana-Marija Rus
From University of Ljubljana, Slovenia

The human mind is crucially dependent on its biological basis, the brain, and considering our moral judgments are fixed on our decisions and actions, one would expect that information concerning the neural footings of the human decision-making process and action to have a significant implication on our legal judgments and therefore law.

The relationship between law and neuroscience, with the brain lying in as the correlative factor, is therefore somewhat apparent, as it possibly offers a more comprehensive and accurate approach to the legal phenomena and possibly puts forward more conclusive evidence for the legal process, thus granting a fairer justice system. “Anything that leads to a better, deeper understanding of people’s minds plays right to the heart of human society and culture—and as a result, right to the heart of the law,” says Henry T. Greely. “The law cares about the mind.”

Even the Grand Chamber of the European Court of Human Rights (EChHR) finds it beyond dispute that the fight against crime depends to a great extent on the use of modern scientific technologies of investigation and identification.

Nonetheless, the use of neuroscientific evidence in the courtrooms can be traced back to 1940 when an EEG was first used in an American courtroom in a case involving a defendant with epilepsy. By the same token, in the criminal case of Florida v. Grady Nelson, the defendant provided an EEG scan as evidence of functional abnormalities in their brain in an attempt to mitigate a death sentence. Similar in practice, there is the infamous insanity defense from the English case law with its core in the M’Naughten rule.

2 Supposing that the law is not valuable per se, as it is instrumentally used to regulate human behaviour in order to attain justice, and for this purpose, we need an in-depth understanding of human action.
4 Professor by courtesy of Genetics, Stanford School of Medicine; Director, Center for Law and the Biosciences; Director, Stanford Program in Neuroscience and Society; and Chair, Steering Committee of the Center for Biomedical Ethics.
6 S. and Marper v. the United Kingdom, § 105.
7 Modern neuro-technology, the study of a brain in some form in quasi criminal proceedings can be traced back to ancient Egypt and ancient Greece. (Shen, “The overlooked history of neurolaw” (2016))
9 Additionaly, there is the case of The United States of America v Lorne Allan Semrau. Where fMRI evidence was offered in court in a failed attempt to prove that the defendant did not intend to defraud the mighty US government.
10 The application of the rule requires testing that a perpetrator does not know that their action was wrong, as they are unable to understand the moral nature of their actions due to cognitive disability. However, the M’Naughten rule tends to disregard the idea that is plausible that a perpetrator retains their cognitive abilities to discern the morality of their actions, while simultaneously being unable of regulating it, which has proved to be rather problematic in courts.
With today’s advancements in neuroimaging techniques and new researchers interested in the function of the human brain, we have been as a society presented with the opportunity to examine among other things the neurobiological correlates to human behavior. Notably advances in the use of neuroimaging techniques in combination with A.I., specifically machine learning techniques, has led to the development of brain-reading technologies which, could have many incredible applications, such as (a) lie detection, (b) detection of whether a stimuli (e.i. a picture or an object) is familiar to the person, (c) assessment of mental capacities and performance, as well as mental disorders and (d) identification of preferences, such as likes or dislikes. A very interesting application of the use of neuroimaging together with machine-learning algorithms is identifying an individual's “real-time thoughts”. Using the technology in a laboratory setting, the researchers have been able to detect actual thoughts in real-time about abstract physics concepts, and also identified suicidal thoughts with 91 % accuracy.

The neuroscientific apprehension of subjective thoughts is bound to have a remarkable impact on several areas of society, including (criminal) law as well as other areas, inter alia insurance companies, water that can access to request such a procedure to obtain information in order to assess the risk of a particular client.

Brain mapping methods could additionally, for instance, be helpful in increasing the accuracy of risk assessment and identifying possible interventions. Therefore advances in neuroscience could make a more accurate

11 Most present-day neurolaw studies mainly focus on neuroimaging technologies, such as magnetic resonance imaging (i.e. MRI), functional magnetic resonance imaging (i.e. fMRI), computed tomography (i.e. CT), and electroencephalography (i.e. EEG). We can group the above-listed neuroimaging technologies into two categories: structural and functional neuroimaging technologies, considering that structural technologies, such as MRI and CT, reveal the biological structure of the brain (i.e. brain anatomy) and functional technologies, such as fMRI and EEG, measures brain activity (i.e. brain physiology).

12 So called concealed information test.

13 In the context of criminal justice, they may include, for example, information regarding whether the defendant recognises a particular gun or lies about a specific alibi at a specific time.


15 Specifically for the determination of fitness to stand trial, assessment of culpability, the applicability of the insanity defence, or for substantiating claims of victims.

16 Simpson, “Neuroimaging in forensic psychiatry: From the clinic to the courtroom” (2012), available at: https://www.wiley.com/en-

17 Glenn and Raine, “Neuropsychology: Implications for the punishment, prediction and prevention of criminal behaviour” (2014)


21 Meynen, “Ethical Issues to Consider Before Introducing Neurotechnological Thought Apprehension in Psychiatry” (2019), p.4

22 For instance, a study by Aharoni and colleagues found a “neocognitive biomarker for persistent antisocial behaviour”, which they extended to “neuroprediction of future arrest”. The researchers tested ACC activity in subjects (n = 96) through an
and unbiased justice system since the judicial ascertainment (often) depends on various scientific discoveries, the question arises whether neuroscientific discoveries can contribute to more reliable objectification of legally relevant subjective facts?\textsuperscript{24} Or could brain-based testing wrongly condemn some and trample the civil liberties of others?\textsuperscript{25} Moreover, the increased use of neuroscientific evidence in criminal and civil proceedings has led some to wonder what effects such neuroscientific evidence has on legal decision-makers who are not unfamiliar with neuroscience.\textsuperscript{26, 27}

Studies\textsuperscript{28} show that neuroimaging technologies can contribute to addressing crucial criminal law issues, such as guilt, legal insanity, fitness to stand trial, and the risk of recidivism.\textsuperscript{29} When we try to access pieces of information in the brain via medical technologies, such as fMRI, are we in conflict with the right to respect for private life,\textsuperscript{30} or the right not to incriminate oneself,\textsuperscript{31} or the right to freedom of thought, conscience and religion\textsuperscript{32}? Hereafter I will try to focus on the implication of compulsory governmental acquisition of (personal) information via neuroimaging technologies in the field of criminal law, as they forecast inter alia a scientific lie detector, specifically the legal issues that might arise with their possible application.\textsuperscript{33}

As defendants in criminal procedures are not always cooperative with the authorities, the legal concerns involving consent and coercion when obtaining brain scans ensure. And if so, under what conditions will or should it be legally permissible and morally acceptable to utilize brain-reading against the subject’s will?


Farisco and Petrini, “On the stand. Another episode of neuroscience and law discussion from Italy” (2014)


de Kogel and Westgeest, “Neuroscientific and behavioral genetic information in criminal cases in the Netherlands” (2015)


\textsuperscript{24} Magyar, “The Use of Neuroscientific Discoveries in Criminal and Civil Evidence Law” (2018), p.123

\textsuperscript{25} Chen, “Neurolaw” (2009), available at: https://law.stanford.edu/stanford-lawyer/articles/neurolaw/

\textsuperscript{26} Also in relation to rights and liberties, neurology touches upon the topic of this relating to mind-enhancing drugs or nootropics. Nootropics enhance memory and cognitive and intellectual abilities. Therefore how will or should these enhancers affect an individual’s legal rights in society?

\textsuperscript{27} Petoft, “Neurolaw: A brief introduction” (2015), p. 56

\textsuperscript{28} The use of neurotechnologies to read the subject’s brain in order to obtain information, such as brain-based diagnostics, lie and memory detection. The results of some of such applications are already being used within different criminal justice systems in Europe, including Slovenia, Italy, England and Wales, and the Netherlands, typically to determine guilt or establish a neurological diagnosis relevant to legal responsibility or recidivism risk.


PIF 6.242

www.supremoamicus.org
Regarding coercive neuroimaging in light of the right to privacy, there are two types of coercion, (a) technical or physical and (b) ethical or legal coercion.\(^{34}\)

In the context of physical coercion, a noncooperative or resistant subject could be physically overpowered to enable a successful brain scan.\(^{35}\) The practical relevance is that some functional\(^{36}\) neuroimaging applications require the active cooperation of the subject.\(^{37}\) For instance, some types of brain-based memory detection, like the concealed information test, require the subject to attentively observe the presented stimuli. In such cases, the use of physical force would probably be useless. Additionally, a subject could influence the results of (most) neuroimaging applications through the use of countermeasures, like recalling emotional thoughts or moving his tongue. Physical coercion is, therefore, unlikely to prevent countermeasures like these.

However legal coercion directly or indirectly threatens noncooperation with negative legal consequences for the subject in order to successfully obtain a neuroimaging scan.\(^{38}\) For instance, the subject's cooperation will subsequently allow him to be released on parole. Free and informed consent to a particular governmental action removes state liability under specific European human rights, including Article 8 ECHR.\(^{39}\) However, in the context of criminal justice, it may not always amount to free and informed consent.

Unlike legal coercion, physical coercion implies an (additional) interference with someone’s (right to respect for) bodily integrity, which right is guaranteed by Article 8 ECHR.\(^{40}\)

Furthermore, private life in article 8 ECHR is a broad concept incapable of exhaustive definition. It covers the physical and psychological integrity of a person and may “embrace multiple aspects of the person’s physical and social identity.”\(^{42, 43}\) Any kind of conflict with article 8 ECHR does not necessarily imply a violation of the right. According to Article 8(2) ECHR, such conflict could be justified if it (i) is based on a foreseeable and accessible legal ground, (ii) serves a legitimate interest and (iii) is necessary for and proportionate to the aim (i.e., legitimate interest) being pursued.\(^{44}\) It is beyond dispute that Article 8 ECHR includes protection from collection, storage

\(^{34}\) Meynen, “Brain-Based Mind Reading in Forensic Psychiatry: Exploring Possibilities and Perils” (2017), p.312
\(^{35}\) Thompson, “The Legality of the Use of Psychiatric Neuroimaging in Intelligence Interrogation” (2005), p.6
\(^{36}\) See note 11.
\(^{37}\) Meynen, “Brain-Based Mind Reading in Forensic Psychiatry: Exploring Possibilities and Perils” (2017), p.312
\(^{38}\) And I am not speaking of societal implications of noncooperation that might depict guilt.
\(^{39}\) Ligthart, “Coercive neuroimaging, criminal law, and privacy: a European perspective” (2019), p.3
\(^{40}\) Ligthart, “Coercive neuroimaging, criminal law, and privacy: a European perspective” (2019), p.9
\(^{41}\) Niemietz v. Germany, § 29
\(^{42}\) S. and Marper v. the United Kingdom, § 66
and disclosure of personal data. Personal data is defined as information regarding an individual who could be identified on the basis of the data and other information in the public domain. Any medical intervention against someone’s will, such as compulsory taking blood, saliva or urine, constitutes an interference with the right to respect for physical integrity and thus with the right to respect for private life.\(^{45}\)

Regarding brain mapping technologies, the first two requirements are not an obstacle\(^{46}\) as long as the use of technologies is regulated and based on which it can be applied in the legitimate interest of national security, such as the detection and prevention of crime and/or the protection of the rights and freedoms of others.

However, whether non-consensual forensic neuroimaging will also be necessary and proportionate with the interest pursued, is more at issue.\(^{47} \)\(^{48}\) Ultimately, a “fair balance” has to be struck between the competing interests of the individual on one hand and society. The ECtHR has repeatedly ruled compulsory DNA testing to be proportionate with the aims of the prevention and detection of crime.\(^{49}\)

Therefore, how is compulsory DNA testing and/or fingerprinting,\(^{50}\) different from neuroimaging applications yield data and its implications to the right to respect for private and family life and furthermore to the privilege against self-incrimination?

Brain activity appears to be unique for any individual, similarly to a fingerprint.\(^{51}\) Therefore, in considering non-consensual forensic brain-reading in light of Article 8 ECHR, we should take into account case-law of the ECtHR on forensic fingerprinting and DNA-testing. However, DNA-testing and fingerprinting are used for purposes of identification, whereas forensic brain-reading is not. Second, DNA-testing and fingerprinting do not disclose mental states, whereas forensic brain-reading does.\(^{52}\)

However ultimately, whether a conflict with Article 8 is necessary and proportionate, depends on the seriousness of the conflict. The more serious the violation, the more important its justification should be.\(^{53} \)\(^{54}\)

---

\(^{45}\) Greely & Wagner, supra note 15, at 763–65, 768, 772.

\(^{46}\) Perhaps states need to pass new laws, setting out criteria for the use of such data.

\(^{47}\) Greater mind debated the topic, see: Ligthart, “Coercive neuroimaging, criminal law, and privacy: a European perspective” (2019)

\(^{48}\) S. and Marper v. the United Kingdom, § 101


\(^{50}\) Let’s not forget the refugee crisis and compulsory fingerprinting in the EU.


\(^{53}\) For instance, the ECtHR considers cellular samples to be ‘highly personal’, containing much sensitive information about an individual and a unique genetic code of great relevance. DNA-profiles contain a more limited amount of personal data, but nonetheless contain ‘substantial amounts of unique personal data’, which enables identification of genetic origins and relationships between individuals.

Neuroimaging applications also differ in their levels of privacy and sensitivity. For example, identifying the mere recognition of a particular gun or person through memory detection seems generally to involve less sensitive information than the diagnosis of cancer or a high risk of criminal behavior.\(^{55}\)

In conclusion; non-consensual forensic brain-reading is covered by the general fundamental right to privacy.

Lastly, I will touch upon the right against self-incrimination (Article 6 ECHR). According to ECtHR, the right to remain silent and not to incriminate oneself is a generally recognized international standard that lies at the heart of the perception of a fair trial.\(^{56}\) However, the privilege against self-incrimination “does not extend to the use in criminal proceedings of material which may be obtained from the accused through recourse to compulsory powers, but which has an existence independent of the will of the suspect, such as documents acquired pursuant to a warrant, breath, blood and urine samples, and bodily tissue for the purpose of DNA testing.”\(^{57} 58\)

A “means-based” interpretation of the privilege states that information that can be obtained without the cooperation of the suspect, therefore independent of the defendant’s will, is out of privileges scope.\(^{59}\) Therefore the question concerning neuroimaging forensic technologies is whether the defendant’s cooperation is necessary in order to obtain the wanted information and structural\(^{60}\) neuroimaging technologies do not require the cooperation of the subject. At least in theory, where the intended results can be obtained while the subject is under anesthesia.\(^{61}\)

Therefore, non-consensual structural neuroimaging, does not, according to this view, fall within the scope of the right against self-incrimination. As a consequence, the right not to incriminate oneself seems mainly to protect against non-consensual functional neuroimaging that requires cooperation, such as the detection of lies and memories.\(^{62}\)

To provide adequate legal protection from such non-consensual brain-reading in the European legal context, ethicists have called for the recognition of a novel fundamental legal right to mental privacy.\(^{63}\)

To conclude, neurolaw could generate a better and wiser judicial, even legislative and executive system.\(^{64}\) However how far will we go to obtain it? Will we disregard the individual's rights in exchange for the truth, that we could obtain through neuroimaging


\(^{56}\) Guide on Article 6 of the European Convention on Human Rights, available at: https://rm.coe.int/1680304c4e

\(^{57}\) Saunders v. the United Kingdom, § 69

\(^{58}\) Guide on Article 6 of the European Convention on Human Rights, available at: https://rm.coe.int/1680304c4e

\(^{59}\) Redmayne, “Rethinking the privilege against self-incrimination” (2007), p.220

\(^{60}\) See note 11.

\(^{61}\) Redmayne, “Rethinking the privilege against self-incrimination” (2007), p.211

\(^{62}\) Redmayne, “Rethinking the privilege against self-incrimination” (2007), p.211

\(^{63}\) In the U.S. legal context, a right to ‘mental privacy’ that protects citizens from non-consensual brain-reading has been advocated. In Europe, Marcello Ienca and Roberto Andorno have called for the recognition of a novel fundamental right to mental privacy, and so has Andrea Lavazza.

\(^{64}\) Petoft, “Neurolaw: A brief introduction” (2015), p.1
technologies? Do we need in the legal system a right against self-incrimination, if we could accurately retain truth from an individual? Does the goal justify the means? I hope not.

*****