

Assessing the impact of the neuroscientific revolution on ethics and law

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«It is not me, it is just my brain, that did it.» This could in the future become a common strategy that defendants use in courtrooms: admitting they have committed a serious crime but arguing that because of some neurological disorder or as the result of a defective brain implant, they should not be held responsible. Neuroimaging technology results showing a malfunctioning brain could be used in years to come as an indicator of the dangerousness of the accused and could influence the criteria that courts use in imposing a sentence. Judges could be increasingly led to make their decisions in accordance with the moral correlates shown in the brain scans of defendants.

In the past few years, a neuroscientific revolution has been under way. Neuroscience has rapidly increased our knowledge of the functioning of the human brain, providing us with an insight into the mental processes underpinning human behaviour. This explosion of interest in neuroscience has resulted in the development of many neurofields, from *neuroaesthetics* to *neuroeconomics* and *neuromarketing* [1]. But as we learn more about the brain, we also learn more about human thought and motivations. These new understandings and knowledge about the functioning of the human brain are of great relevance to ethics and law, given that these are disciplines primarily concerned with the normative dimension of human behaviour. This is why ethicists and legal scholars were from the very beginning interested in the impact of neuroscientific advances, resulting in the rapid development of two new fields, i.e. neuroethics and neurolaw.

Neuroethics has a two-fold focus. The first deals with the ethical issues in the design and conduct of neuroscientific studies and includes topics already known in bioethics, such as informed consent, privacy, risk assessment, etc. but applied to the specific field of neuroscience; the second is truly novel as it attempts to investigate the impact that our growing understanding of brain function may have on our ethical, social, and philosophical conceptions, and includes issues like personal identity, freedom and responsibility, consciousness, and the mind-body problem [2]. Neurolaw attempts to explore the influence that neuroscience's discoveries may have on legal rules and court decisions, in particular the use of evidence resulting from neurotechnologies.

The new techniques which allow us to measure and assess mental states range from electroencephalography (EEG), magnetoencephalography (MEG), positron emission tomography (PET), single photon emission-computed tomography (SPECT), to structural and functional magnetic resonance imaging (MRI and fMRI respectively). Today, legal practitioners increasingly seek to employ cognitive neuroscientific methods and data as evidence to influence legal proceedings. Neuroimaging methods – primarily used to study brain and behaviour relationships in order to contribute to clinical and research disciplines [3] are progressively finding their way into legal procedures and have already been applied to many legal subfields, including civil law as well as criminal law. From an ethics point of view, neuroethicists are beginning to wonder whether brain imaging has the potential to become the ultimate «lie detector» [4], or whether neuroimaging can give us information on the way moral judgment is constructed and even influenced by neuropharmacological or similar forms of interventions.

In cases of end-of-life issues, neuroscience is already being introduced in courts to produce evidence of consciousness. Regarding disability benefits, it is used as evidence of pain and suffering, while the potential use of neuroscientific techniques during the employment procedure for the selection of future employees is a topic of broad discussion. The implications of these uses are not only legal, but philosophical: it is likely that new neuroscientific knowledge and techniques will challenge our traditional perception of personhood, the special status of human consciousness, and our views about its beginning and its end.

In criminal law, the increasing understanding of our brain and, as a result, our ability to know more about minds and mental states, may fundamentally change our conceptions of free will and the way we hold people responsible. In the long term, it could potentially influence all stages of the criminal procedure, from investigation and the assessment of criminal responsibility, to punishment, treatment of mentally ill offenders with direct brain interventions and the evaluation of their dangerousness. Some say that neuroscientific evidence will have a large impact not only on questions of guilt and punishment but also on the detection of lies and hidden bias, and on the prediction of future criminal

behaviour. Lie detection technologies are already being offered by US companies, which claim that within the next 5 years they will be 100% accurate and ready to be used in courts [5].

Neuroscience has already come to play a part in legal procedures, especially in the United States. The clear example is the Brian Dugan case, which became in 2009 the first in the world where fMRI scans were admitted as evidence at a criminal trial [6]. According to the expert hired by the defense, Brian Dugan, a serial killer and rapist, was unable to feel empathy. He had a psychopathic brain, which showed decreased level of activity in the limbic system, involving the orbitofrontal cortex related to decision making and ethical behaviour. The jury deliberated for more than 10 hours about the brain scans evidence but in the end, it decided to sentence Dugan to death, the sentence having since been commuted to life imprisonment.

In 2008, a woman in India was convicted of murder on the basis of a method of lie detection based on electroencephalography, related to so-called «brain fingerprinting», an EEG technology developed by Lawrence Farwell in the United States. The Indian judge explicitly cited a scan as proof that the suspect's brain held «experiential knowledge» about the crime that only the killer could possess, sentencing her to life prison.

In European courts neuroscientific evidence has gradually started to penetrate as well. In 2009, the Court of Appeals of Trieste reduced the sentence of a man convicted for murder, based on brain scan evidence and on his possession of certain genetic variations. In September 2011, the Court of Como reduced the sentence of a woman accused of homicide from 30 to 20 years imprisonment. The defending attorney presented an insanity defense based on psychiatric, neuroscientific and genetic tests, in order to scientifically demonstrate that the accused was partially insane at the time of the crime. Numerous other cases, civil and criminal, have been filed in the UK, The Netherlands and other European countries.

These are just some examples of how neuroscience advances raise huge legal and ethical issues and have significant implications for our understanding of ourselves as free and responsible beings, and for existing ethical frameworks and legal regulations.

Although there have been significant efforts in the US to identify and assess these new challenges, the discussion on the neuroscientific issues that are at the inter-

section of ethics and law are still at the very early stage in the European context. Considering this state of affairs, the authors of this Viewpoint took the initiative to establish the Swiss Network on Neuroscience, Ethics and Law (SNNEL). This interdisciplinary online platform aims to promote discussion in Switzerland about the ethical, legal and social implications of neuroscience and to inform researchers, neuroscientist policy makers and lawyers about the impact the growing understanding of the brain may have on our self-understanding as individuals and society. As a starting point of the Network, a Blog aiming at bringing the interested community together has been put in place [7].

Another initiative of the recently created Network was to organise an international workshop on «Neuroscience, Ethics and Law: New Challenges for Human Identity, Freedom and Responsibility». This event will take place in November 2013, thanks to the funding by the Brocher Foundation. It will gather a number of recognised experts such as Owen Jones, Martha J. Farah, Nicole Vincent, Amedeo Santosuosso, Tade Spranger, Matthias Mahlmann, among others. With these and other activities we hope to modestly contribute to start a vivid, interdisciplinary debate on neuroethics and neurolaw in Switzerland, underlining the benefits, but also the risks of neuroscientific advances.

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