The Ethical Implications of Considering Neurolaw as a New Power

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Caution is one of the orienting principles of neuroscience’s advance in different social spheres. This article shows the importance of maintaining caution in the area of neurolaw because of the risk of it becoming a new power that is free from ethical discussion. The article’s objective is to note the principal ethical implications and limitations of neurolaw in light of six cases in which neuroscientific evidence was used in distinct ways. This study seeks to examine the precautions that should be taken in regard to the advance of neurolaw so as not to lose sight of its emancipatory interest.

Keywords: neurolaw, neuroscience, ethics, cases, responsibility

PRACTICAL REASON IN THE FACE OF ADVANCING NEUROLAW

Neuroscience is now providing a great deal of knowledge about the human brain. Its discoveries and contributions have practical inferences for areas such as politics, education, economics, marketing or law. This knowledge is frequently considered very cautiously, since what it provides is an understanding of how the brain works at its physiological base, and because human rationality and human freedom are determined neither by the images provided by functional magnetic resonance image (fMRI), nor even by the person’s own brain. Nevertheless, sometimes the positions held on practical rationality in these and the other areas mentioned above use neuroscientific knowledge as a “new power” (Dunagam, 2004; García-Marzá, 2012). In other words, neuroscientific knowledge is granted objectivity and scientificity not only for its new knowledge about the bases of the human brain, but also for its application on the grounds of practical rationality. The present paper discusses the ethical implications of this approach to neurolaw from the critical concept of “neuropower”.

The ability to predict the future based on “brain reading” is now regarded as fiction, but the ability to study and know the mind through advances in neuroimaging is increasing at a dizzying pace. Moving away from fiction and into the current reality, neuroscience and criminal justice already offer examples of the application of neuroscientific techniques to criminals. What is known as *therapeutic justice* is already being implemented in some parts of the United States (Farah, 2011, p. 770); for example, rapists and sex offenders receive long-acting forms of anti-androgen medication. Similar treatments include *Selective Serotonin Reuptake Inhibitors* (SSRIs) that decrease violent impulses by increasing extracellular levels of the neurotransmitter serotonin. These techniques are a result of the clinical use of neuroimaging for direct intervention on criminals, albeit with a preventative intent.

Beyond clinical and therapeutic applications in criminal treatment that have already been recognised, neuroscience applications—above all, neuroimaging techniques—have been extended to the detection of supposed criminals (Laureys et.al., 2009, p. 35; Owen, 2011, p.

135). Brain scanners, functional neuroimaging, and electroencephalograms now promise to reveal criminal responsibility in the human mind (Langleben et al., 2002; Lee et al. 2002).

Given these types of promises, it is appropriate to ask whether neuroscience is relevant to criminal responsibility. Can brain scanners detect criminals? If not now, could they one day do so? When and with what techniques? Most importantly from an ethical point of view, will these advances continue to guarantee constitutional rights, or will they bypass citizens' rights and freedoms in the eagerness to search for and/or find those responsible for a crime?

In our attempt to answer the ethical questions, as well as others that could arise in the area of neurolaw, we present six cases—two from the United States, two from Spain, and two from Italy. These cases exemplify the different ways the results of tests applying neuroscientific techniques as incriminating or exculpating evidence are accepted in judicial proceedings. Above all, the cases demonstrate the difficulties of attempting to determine responsibility through the use of advances in this area of law and whether neurolaw represents a new form of social power. These examples show that in the realm of the judicial system and the law, neuroscientific discoveries have potential applications in the same areas and manner as psychology, except that neuroscience-based evidence, and especially neuroimaging, has a greater normative and methodological character. Despite the fact that many continue to believe that functional neuroimaging has never been used as definitive trial evidence to justify a conviction (Farah, 2011, p. 770), cases such as that of Terry Harrington in the United States or Antonio Losilla in Spain show that this is not the case. What was a *potential threat* in 2011 indicated by M. Farah, is now *creeping in*.

TERRY HARRINGTON AND JAMES B. GRINDER

In November 1978, an all-white jury declared Terry Harrington, a 17-year-old black minor, guilty of the first-degree murder of retired police captain John Schweer in the state of Iowa. Apparently, Harrington and another subject attempted to steal the victim's car on the night of the murder. Despite presenting a reasonable alibi, the accused was declared guilty and spent 25 years in prison for a crime that, as discovered in 2003, he did not commit (The National Registry of Exonerations, 2014).

The motive for his release was the acceptance of Brain Fingerprinting as proof of innocence (Peiró, 2013). This technique consists of an electroencephalogram (EEG) that measures one's event-related potential, known as P300, that represents information that accompanies the recognition of a stimulus in comparison with a remembered context (Farwell and Makeig, 2005, p. 7). Changes in electrochemical brain signals are measured using a series of electrodes placed on the scalp and are registered using an electroencephalogram (EEG). The EEG registers signals that reveal information about cerebral processes. These signals are detected through temporary changes to the EEG in response to the appearance of stimuli such as hearing a sound or seeing an image. The resulting activity is known as event-related potential (ERP), which is distinguished from standard, unaltered neural activity. ERP can be broken down into a series of components that are represented as positive or negative fluctuations of the brainwave. What occurs before the first 100 milliseconds reflects the earliest sensory information. A longer ERP latency includes P1, P2, N1, N2, 400, and P300 components, so named for polarity (P being positive) and position (P1 is the first positive wave) or latency after the stimulus (N400 is the negative fluctuation 400 milliseconds after the stimulus). Generally, what occurs during the first 250 milliseconds of exposure to a stimulus reflects pre-conceptual processing, while after 250 milliseconds, it is believed that higher cognitive processes such as memory and language are reflected (Farwell, Richardson & Richarson, 2013, pp. 265-266; Murphy, 2012).

In essence, the EEG measures an unconscious mechanism and evaluates the subject's response in real time to stimuli in the form of images or words on a monitor. A series of electrodes is connected to the subject's scalp and measures brain responses to these stimuli without the need for a direct and conscious response from the subject, thus differentiating this technique from others, such as the polygraph lie detector.

The P300 signal—that is, the neurophysiological events that occur in the brain during the first 300 milliseconds after exposure to a sensory stimulus—supposes an extension of what Dr. Larry Farwell called memory and encoding-related multifaceted electroencephalographic response (MERMER) and indicates the information present in the brain and stored in the memory regarding various stimuli. This information can be relevant or irrelevant to the case being investigated, according to whether it coincides with the proposed stimuli.

Brain Fingerprinting, as L. Farwell stablished (Farwell, 2011; Farwell et al., 2013), mathematically analyses brainwaves produced in response to a stimulus, thus determining whether this information is present or absent in the brain's memory. Brain fingerprinting, as well as regular fingerprinting used in the biological analysis of crime scene DNA, in this case compares information stored in the brain with information from the crime scene. If the information is present, there is a neural response from the P300-MERMER indicating that the subject possesses relevant information in response to the given stimulus. On the contrary, the absence of information does not produce a wave variation in brain response from the P300-MERMER, indicating that the stimulus presented is unknown to the subject and is not present in his or her memory (Farwell, 2013; Farwell & Makeig, 2005). The MERMER signal will therefore only appear in the P300 when the subject is the perpetrator of the crime because the subject's memory would contain details about the crime shown by the brain's reaction to the stimuli presented. In effect, the MERMER signal is part of the brainwaves observed in response to familiar information. When the brain recognises something familiar, memory is stimulated and neurons fire, giving way to changes characteristic of brain activity. These changes can be detected using electrodes, through which researchers can determine whether the subject recognises part of the information.

The method's efficacy has been shown in other studies in collaboration with FBI and CIA agents (Farwell et al., 2013, pp. 269-272). According to Dr. Farwell, the principal proponent and patent holder (Farwell, 2010), the method's supposed fallibility in judicial contexts is minimal, with efficiency in 99.9% of cases. According to Dr. Farwell, it is practically impossible to deceive the machine because the subject does not have to respond, and the variability of the subject's brainwaves is directly analysed within 300 milliseconds of presenting the sensory impulse (Farwell & Makeig, 2005, p. 8).

In *Harrington v. State*, Dr. Farwell developed a series of tests about the crime scene and the supposed alibi and presented them in the form of visual stimuli to the convict in a Brain Fingerprinting (or P300-MERMER) evaluation. On November 10, 2000, he presented a report to the court in which he requested the convict's release based on the fact that the neural information shown when presented with stimuli related to the alibi coincided at a rate of more than 99%.

Given this report, the judge and jury had to determine whether the tests were sufficiently relevant to allow them to be used as judicial evidence of innocence. In other words, in light of the fact that the tests consisted of a series of very innovative psycho-physiological applications, certainty was required regarding whether the data were trustworthy enough to change a guilty verdict to innocent. The most interesting aspect of this decision was the required criteria for the experiments to be accepted as evidence. First, whether the tests had been published in journals with blind peer review was considered. Regarding this requirement, components of event-related potential had indeed been published (Farwell & Donchin, 1991). Second, the court considered whether the tests had been previously used in real conditions and not only in the laboratory. It was demonstrated that the technique had been used in CIA and FBI experiments, which was later reconfirmed (Farwell, 2011). Third, the court considered whether the scientific community generally accepted the technique (Farwell & Makeig, 2005, p. 7). In light of the consensus within the psychophysiology community, the jury determined that the Brain Fingerprinting test was valid as evidence and exonerated Harrington in 2003.

The case of James B. Grinder was radically different. Brain fingerprinting was not used to release him but rather as the final evidence implicating him as the principal perpetrator of Julie Helton's murder. For 15 years, Grinder was the principal suspect in Helton's murder, but incriminating evidence sufficient for conviction had not been discovered. Beginning in 1984, when the victim was raped and violently murdered, the suspect gave various contradictory versions of the events. Eventually, Grinder underwent Dr. Farwell's Brain Fingerprinting test in 1999. During the test, the accused was shown short phrases on a monitor, some of which were especially relevant because they contained very detailed information about the murder that only the real killer would know. These phrases and bits of information contained, for example, the murder weapon, the procedure by which the victim had been killed, injuries and wounds to specific areas, etc. The test results showed a 99.9% coincidence between the details given as stimuli and the memories in Grinder's brain, with a quantity of sufficiently relevant information for the suspect to be considered guilty (Farwell, 2013).

The test showed that the information present in the mind of the accused included very significant details of the case even 15 years after the victim's murder. There was no doubt expressed that the MERMER signal from Grinder's brain emitted very significant details that identified him as the perpetrator of the crime. Grinder's case was the first judicial proceeding in the United States in which an encephalogram test was accepted as the prosecution's principal argument, and it helped lead to the suspect's conviction. Although there was also evidence that indirectly incriminated Grinder, it was only the P300-MERMER that directly incriminated him.

ANTONIO LOSILLA AND MIGUEL CARCAÑO

Antonio Losilla, who was suspected of murdering his wife, Pilar Cebrián, underwent cognitive-evoked potential or Brain Fingerprinting testing on December 18, 2013 to attempt to determine his guilt and orient the search for the victim's body. The 51-year-old victim disappeared in April 2012 in Ricla (which is also the name of the police case), and Losilla waited a month before reporting her disappearance. An investigation found evidence that her husband could have been the perpetrator due to the amount of time that he waited before reporting her disappearance and because of blood found in the family garage. Despite this circumstantial evidence, there was no decisively incriminating evidence (Peiró, 2013).

Dr. José Ramón Valdizán, the former Director of Neurophysiology at the Miguel Servet Hospital in Zaragoza, suggested administering Losilla the neurophysiological test P300-MERMER, just as Dr. Farwell did in the Grinder case. Although Losilla's defence attorney appealed the order that authorised the test, the P300-MERMER was administered before a decision on the appeal was rendered. The defence's argument was that the test threatened the accused's fundamental right against self-incrimination.

The P300-MERMER test administered to the accused had two parts. First, various visual stimuli were shown, including images of possible places where the victim's body could have been buried. In the second test, the stimuli were auditory. Phrases about the victim were spoken to register Losilla's brain activity. Although the body was never found, the suspect's confession was the final evidence used to convict him. Losilla admitted to chopping up his wife's body, but he said he had not killed her. In his version, they were fighting and she fell down the stairs. He subsequently left the house, and when he returned, he saw that his wife was dead, so he decided to cut her up and hide the remains.

More recently, the "sea" case, whose principal perpetrator was Miguel Carcaño, also used the cognitive evoked potential P300-MERMER test. However, the objective of this test was not to provide evidence implicating Carcaño, as he had already been found guilty, but rather to find the body of Marta del Castillo. The National Police asked the 4th Court of Instruction of Seville to submit Carcaño to the neurophysiological test, as with Losilla. The police believed that the test did not violate any of the convict's constitutional or personal rights because Carcaño had already been sentenced. In this instance, the test was only used as a tool to locate the victim's body (Gallego, 2014).

The use of the test was favoured because over the previous five years, Carcaño had given multiple versions of the events and the location of the victim's body (e.g., the Guadalquivir River, the Alcalá de Guadaría garbage dump, the Majaloba farm in La Rinconada). In addition, the police had unsuccessfully tried geographic tracking techniques such as georadar, used for scanning underground passageways, so the court decided to use a scanner on the brain of the convict, who now must spend 21 years and three months in prison (Gallego, 2014).

DOMENICO MATTIELLO AND S. A.

Neuroimaging and electroencephalogram techniques have not only been used in the United States and Spain but also in Italy. Although these technologies were not used to condemn or acquit the accused in the two cases presented, the cases demonstrate the disagreement, even within the scientific community, over the use of these techniques as trial evidence.

The first case refers to an alleged crime of sexual abuse of minors committed by an Italian paediatrician. Domenico Mattiello, who was 65 years old, was found *in flagrante delicto* and charged with trafficking child pornography and previous abuses (Millburg, 2012). The accused's defence presented a series of neuroimages from an fMRI scan with the intention of showing that the abusive actions were caused by a brain pathology resulting from a tumour. This tumour, a clivus chordoma, caused damage to the orbitofrontal lobe and the hypothalamus, thus producing changes in Mattiello's behaviour (Farisco, 2014, p. 1).

However, the supposedly empirical evidence provided by the fMRI was also analysed by experts requested by the prosecution, who presented radically different conclusions than those of the defence. The prosecution's experts determined that there was a tumour; however, it did not create pressure on the orbitofrontal lobe but rather on the pons Varolii, i.e., the middle-lower part of the brainstem and the pituitary gland (Farisco, 2013). Therefore, the tumour did not fully or partially compromise the subject's capacity for consciousness and agency at the time of the crime.

These two interpretations of the same supposedly empirical evidence demonstrate the lack of unanimous consensus among neuroscientists regarding the specific role of certain areas of the brain and their impact on an accused's responsibility and decision making. It is unsurprising that in Mattiello's case, the court dismissed the fMRI as either incriminating or exonerating evidence. Beyond that case, testing for a correlation between neural dysfunction and paedophilia has been demonstrated in only a very small number of cases (Burns & Swerdlow, 2003; Jawad et al., 2009).

The second case involves the 28-year-old Italian woman S. A., who brought financial ruin to her own family due to her compulsive shopping addiction. In 2009, after an overdose of psychiatric drugs, S.A. killed her sister, set the body on fire, and left a false suicide note in her sister's name. S. A. was later detained for an unsuccessful murder attempt against her mother, who survived and denounced her (Farisco and Petrini, 2012: 25). After an initial psychiatric exam, it was determined that S.A. suffered from some type of mental illness, but there was no specific diagnosis. A second evaluation incorporated the opinions of cognitive neuroscientists and behavioural geneticists and showed a lack of integrity and functionality in S.A.'s anterior cingulate cortex, which is potentially associated with obsessive-compulsive and anger disorders (Farisco & Petrini, 2012, p. 25). Techniques used in the second evaluation included an EEG and the Autobiographical Implicit Association Test, though these tests did not serve to prevent S. A. from being sentenced to 20 years in prison, three of which were served in a psychiatric hospital.

Despite the neural and genetic evidence provided, the judge in the case ruled that, while informative, these tests could not be used as determinants for condemning or acquitting the accused because they were not considered tests of determined objective value. This finding shows that the relationship between genes, the brain, and behaviour continues to be controversial.

ETHICAL IMPLICATIONS OF NEUROLAW

After examining the six cases, it is now convenient to return to the initial question: Is neuroscience relevant in determining criminal responsibility? The examples provided posit three potential responses. In the two US cases, the Brain Fingerprinting or P300-MERMER test patented by Dr. Farwell was used as the main exonerating evidence in one murder case and as the main convicting evidence in another. The test results provided the principal argument for exonerating a convict after 25 years in prison and for convicting another. In the two Spanish cases, the same cognitive evoked potentials test, while not used as the principal evidence for conviction, was used as supporting evidence to resolve other issues in two murder cases, namely, the locations of the victims' bodies. In the two Italian cases, the two functional neuroimaging tests received different interpretations from within the same scientific community, which caused the judges in the two cases to dismiss the tests as evidence at trial because of a lack of agreement regarding the accused's responsibility at the time the crimes were committed.

As a result of these cases, what does the general acceptance of neuroscience tests imply for the acquittal or conviction of accused suspects, such as in the US cases? What does the acceptance of neuroscientific evidence mean for releasing a subject from responsibility and decision making if the decision was caused by cerebral dysfunction, as in the Italian cases? Finally, what does the general application of these types of tests as an additional tool in judicial proceedings mean for the accused? Does it threaten their right against self-incrimination by granting brainwaves more importance than the defence's arguments?

From a philosophical perspective, it is impossible to concretely respond to the question of neuroscience's relevance in determining responsibility with a simple "yes" or "no". According to Vincent (2010), this question is not specific enough, and therefore, one must first determine which neuroscientific techniques and which criteria or concept of responsibility we are referring to. It is generally possible to establish three limitations regarding the applicability of neuroscience in assessing criminal responsibility (Vincent, 2010, pp. 79-80).

a) Is neuroscience currently relevant for determining criminal responsibility, or will it be capable of doing so in the future?

b) Are neuroscience and studies of the human brain homogenous and of a sufficiently uniform character to be referred to as a single grouping? Can neuroscience determine responsibility from a moral point of view?

c) If not, what techniques should be taken into account when we ask whether neuroscience is relevant to criminal responsibility? Some techniques, such as the fMRI, only allow for a brain reading, while others offer the possibility of modifying the brain with a direct intervention — transcranial magnetic stimulation (TMS). Clearly, the degree of relevance would not be the same for direct intervention techniques used in the brain and descriptive techniques. Even in the case of descriptive techniques, the relevance would not be the same depending on whether the accused's collaboration or response was required (in the event that a suspect's response to moral dilemmas was evaluated), as the P300-MERMER test has shown.

There is no unified concept of what human responsibility is from a neuroscientific perspective. In our opinion, Vincent correctly analyses different conceptions of responsibility, such as determining that causal responsibility is different from virtuous responsibility or the ability to be responsible, among others (2010, pp. 80-92).

For that reason, before attempting to determine whether neuroscience is relevant to criminal responsibility, it is necessary to clarify, from a neuroscientific perspective, the techniques and the definition of responsibility that are in question.

Greene and Cohen (2004) adopt a less prudent position in attempting to show that current notions of legal justice, despite appearing to be compatible, are actually based on an intuitive libertarian idea that only considers free will. In other words, according to these authors, current neuroscientific discoveries can threaten the idea of free will and retributive justice. This is a less cautious approach, as discussed below, showing a belief that neuroscience will change the deepest notions of law, but such a belief is grounded in a particular conception of the mind-brain relationship, in which the mind is reduced to brain. However this theoretical position and its assumptions are unwise for two reasons. Firstly it maintains the confusion between the empirical and the normative approach; and secondly because localising the bases of the brain does not allow fundamental changes to be established in a social science.

In the opinion of Greene and Cohen (2004), the current legal system universally assumes human beings' capacity for rational choice, implying that people considered legally responsible have a general ability to influence their own rational behaviour. In this sense, legal reasoning requires a demonstration of the absence or lack of this general rational capacity. Neuroscientists could help corroborate whether a subject is conscious of what he or she is doing at the time of committing a crime, but they cannot dictate a substantial change in the legal concept of responsibility unless they were to show that the general tendency toward rational behaviour is incorrect. However, if some branch of science could make such an assertion or show that human behaviour is occasionally irrational, it would have to be a branch of science that studies physical causes in the brain, such as neuroscience (Greene & Cohen, 2004, p. 1778).

These authors ask how neuroscience could help change the current concepts of legal justice. If, as they believe, the basis of law is an inadequate reflection of humans' moral intuitions and social pacts, neuroscience could have the opportunity to change the current concept of justice. Such ideas would not necessarily have to be revolutionary concepts that solve other problems (such as the mind-body relationship) but rather ideas that change people's moral intuitions through empirical brain testing.

Greene and Cohen hope that neurodeterminism or brain determinism can become sufficiently accepted to question the current legal and moral concept of free will and responsibility. Determinism might be broadly defined as the belief that all current and future events, actions and decisions have been causally motivated by previous events, actions and decisions, together with the laws of nature. Determinism seems to be the position most strongly defended by neuroscience today; most neuroscientists appear to be reluctant to accept the possibility that something with new and different properties emerges—and is not reduced—in a different level of organisation (Gazzaniga, 2011, p. 158).

According to Greene and Cohen's deterministic perspective, the central question of interest for society regarding justice is whether guilt lies with the person, the circumstances, the brain, etc. For these authors, no guilty person is disconnected from these other aspects. Essentially, the justice system's interest in "rationality" forgets something that is intuitively important. What people really want to know is if the accused is guilty unless proven otherwise, but it is precisely this "unless" where the brain, genes, and environment come into play.

Accepting brain determinism would help to end two noticeable tendencies: psycholegal errors (Morse, 2004) and the belief that human beings are "uncaused causers" (Wegner, 2002). Psycholegal errors consist of thinking that an abnormality in the brain is in and of itself an excluding condition. This mistake is the reason that people are continually creating or trying to validate new syndromes that affect behaviour (Morse, 2004, p. 180; Greene & Cohen, 2004, p. 1778). This was also the mistake made by the defence in the previously referenced case of Domenico Mattiello. If neuroscience had a greater role in judicial trials, and it was accepted that we are determined by our brains, psycholegal errors would be eliminated because having a brain dysfunction would not be an excluding condition; thus, it would be commonly accepted that we ultimately depend on our brain when making decisions. Second, positing that humans are uncaused causers, following Wegner (2002), means that our actions appear to be caused by the mental states but not the physical states of our brains, and we imagine that we are metaphysically special. Admitting that brain determinism exists and giving a greater weight to the neurosciences in legal and judicial proceedings assumes that human actions are determined by our brains, which in turn depend on genes and the environment, and that our actions are the cause of other processes.

Despite Greene and Cohen's attempts to prove that the retributive character of the penal justice system is counterproductive, in our opinion the correct path is not to recognise brain determinism at that level or to think that neuroscience can radically change the concept of legal justice or the moral concept of personal responsibility. Neuroscience, despite its great ability to provide information about the brain, is still far from providing the sufficient prescriptive capacity to change or outline the framework for the conditions of human free will. Following Pardo and Patterson (2011, p.38) legal thought cannot be reduced to the brain function or to the brain localisation. Despite its advances, it is still possible to recognise various limitations, both methodological and epistemic, in the field of so-called neurolaw.

The limits of neurolaw are not solely methodological

Today, the limitations of neurolaw are apparent in two areas: the methodologies used and its epistemological ambitions. Various authors have recently addressed this issue. Some, such as Pardo and Patterson (2013), find that there are insurmountable difficulties in neurolaw, while others, such as Robins and Craver (2011) and Levy (2014), recognise the current deficiencies and are working to show neurolaw's logic and potential contribution. To examine the main difficulties exposed by the cases presented, we focus on four aspects that we believe illustrate some of the issues that should be addressed in the future development of this field.

The first aspect concerns the limitations of technology. Can situations controlled in a laboratory be compared with the real situations considered in court? In other words, can we expect the human brain to respond in the same way in both situations? Can neuroscience clearly distinguish evil from psychosis in judicial trials, i.e., the "mad and bad question"? (Vincent, 2010, pp. 93-94). Does the P300-MERMER test really have nearly 99.9% reliability? Even if it does have this level of reliability, does it only apply to what is being measured, or can it also determine whether an accused is guilty? Dr. Farwell frequently alludes to his experiment's reliability: "With both P300 and P300-MERMER, error rate was 0%: determinations were 100% accurate, no false negatives or false positives; also no indeterminates" (Farwell et.al., 2013, p. 263); "less than 1% to characterize the error rate in studies where in fact a 0% error rate was obtained. In addition to 0% error rate, Farwell and Smith also reported 0% indeterminates" (Farwell et.al., 2013, p. 264). Does this small rate of error refer only to the recognition of stimuli in the experiment, or does it also refer to an infallible method of detecting those guilty of a crime? The mere recognition of sensory stimuli should not be the basis for greater punishment or to convict someone of a crime. The recognition of these sensory signals as well as variations in neural signals can be useful in assisting investigations for judicial proceedings, such as in finding the body of Marta del Castillo, who was murdered and then thrown into the sea. In this case the murderer, Miguel Carcaño, was shown many images of different locations; the P-300 MERMER revealed that his brain only responded to the image of one of those places, namely, where he had hidden the body of the victim. Jumping from the recognition of a stimulus to the conclusion that a person is guilty requires an insurmountable argumentative leap that reduces moral and legal argumentative capacity to nil, giving all of the weight to neuroscientific interpretation. In this sense, as García-Marzá explains regarding neuropolitics but that we believe can also be applied to the field of neurolaw, we are confronting a new "neuropower": "We are facing what has been called 'neuropower,' referring to the substantial applications of this new form of power/knowledge. This is neuroscientific discovery at the service of politics," (García-Marzá, 2012, p. 84). In this case, the usefulness of these neuroscientific discoveries is not only political but also legal.

The second aspect that must be addressed is temporal limitation. Neuroimages only contribute information about the brain in its current state, which means that there is a temporal limit, and the neural state of the accused at the time of a crime cannot be shown. Therefore, it cannot be known whether the pathology currently visible is the result of the crime, previous to it, or subsequent to it (Vincent, 2010, p. 95). Regarding this temporal distance and specifically the predictive role of fMRI in judicial proceedings, Crawford argues that if one wants to predict whether someone is going to break the law in the future, a brain image is no better than a past recording of the individual's behaviour. In fact, a recording is more predictive because there is weak evidence linking future behaviour and brain abnormalities (Crawford, 2008, p. 76).

The third aspect is that the jump from an informative to a prescriptive role is too large a leap and requires ethical and philosophical reflection. It is one thing to study or determine that decision-making ability is on occasion influenced by certain neural parameters in which genes, the environment, and our brains play a role. It is entirely different to determine that human free will is a fiction (Libet, 1999; Morse, 2004; Rubia, 2009).

The fourth aspect is that, independently of whether functional neuroimaging is considered irrefutable or informative evidence, its mere consideration in judicial proceedings would completely change the structure of courts and their advisors. The introduction of experts (or metaexperts) into the courts would be indispensable (Farisco, 2014, p. 2). These experts would have to go beyond legal knowledge and incorporate neuroscience. The discussion of the Italian cases directly shows that the interpretation of neuroimages varies according to interests. In those cases, the defence used the same empirical evidence to defend its interests against the prosecution. If the same tests that produce the neuroimages are treated in a radically opposite manner to determine whether an action was carried out freely and voluntarily, then their potential effect is merely hypothetical and not experimental. As Gazzaniga states:

> (…) so psychiatrists and brain scientists might be able to tell us what someone's mental state or brain condition is but cannot tell us (without being arbitrary) when someone has too little control to be held responsible. The issue of responsibility (…) is a social choice (Gazzaniga, 2005, p. 101).

While we disagree with the last part of this quote because responsibility is not only a social issue but also a moral and legal issue, his reflection on the role of neuroscientists is correct. Gazzaniga places "without being arbitrary" in parentheses and notes the interests that influence the interpretation of neuroimages, as seen in the Italian cases. Neuroscience's arbitrariness noted by Gazzaniga was also referenced by Habermas in *Knowledge and Human Interests* regarding the fact that science is not neutral and always has an interest with three orientations: technical, practical, and emancipatory. These three aspects of science always reciprocally need each other (Habermas, 1971). It is in this vein that we believe neurolaw should advance, as a contribution that strengthens our technical understanding and knowledge of human beings and their variability and that allows for the orientation of decisions linked to law (in its elaboration and application) with the goal and aspiration of human emancipation. Neurolaw should therefore not be viewed as an objective science, above all because those who develop and apply neurolaw already possess interests that define its function, development, use, and social pre-eminence.

The entry of neuroscience in the courtroom is seen by some authors as a window of new advantages (Green & Cohen, 2004; Goodenough, 2001). They argue, for example, that neuroscience could provide evidence for the existence of unconscious bias on the part of the judge, jury, lawyers, etc. Sometimes they underline other virtues such as its potential to report on the reliability of memory or perception in testimonies, and even the reliability of a confession. However, there is an important difference in considering neuroscience as an adviser and helper—which can provide some evidence—and in saying that these tests can and should determine a defendant’s liability.

We consider that there is an epistemological and methodological leap, that there is a pretence of neuroscience objectivity and normativity to neurolaw in this case. The implication is that from those objectivistic positions neurolaw is shown as a new power which could even determine criminal liability. As we have tried to argue, functional neuroimaging may come close to assisting in the legal field with the initial functions we mention, as a counsellor or helper, but not by fully determining a defendant’s guilt, as has been claimed in the cases of J. Grinder, T. Herrington, or A. Losilla. That position will be maintained from the discourse ethics tradition where the principle of justice implies an interaction with the other as recognition and the consideration of freedom, responsibility and intentionality as transcendental properties from the environment (Habermas, 2008).

Emergentist mind as a starting point for neurolaw

In order to discuss the ethical assumptions maintained in this paper we can say that the implications that neuroscience may—or may not—have in the conception of law will depend on the concept we have of the mind-brain relationship. And in this vein an emergentist point of view is a cautious and advisable position, as we will argue.

If the conception is materialistic then the identification of mind with brain can give the impression that neuroscience will change the fundamental assumptions of the law, when in fact it will not. There is no doubt that neuroscience is changing our understanding of the brain, but we should not confuse the brain basis with the basic foundations of social science (Cortina, 2011, pp. 94-96). Understanding the neural basis of human behaviour does not allow “brain being” to shift to “legal duty” and that human action cannot be explained solely by physical criteria.

Thus the materialistic conception of the brain and mind poses several problems. First, there is a confusion between the conceptual-normative and the empirical, or rather, there is an identification of the conceptual-normative with the supposedly empirical. The central interest for neuroscience is what affects the neural structure, brain function and physiological bases. And these brain functions are translated into a language that is commonly understood to be “empirical” because hypotheses are tested through experimentation. However, to truly connect with the empirical concept, neurosciences should clearly identify the conceptual part. Mind, memory, emotion and conscience are examples of such concepts, which are not defined in a unified way in the neuroscientific field. It therefore becomes difficult to find the physiological bases of what has not yet been clearly defined. The reduction of mind to brain seems to simplify this problem, because the conceptual is defined by the empirical for the neural bases and the brain localisation. However, this reductionist impulse always explains the mind as something mechanical and causally determined (Pardo and Patterson, 2011, p. 13).

Moreover this materialistic position leads to incurring in the mereological fallacy that M. Bennett and P. Hacker explain in *Philosophical Foundations of Neuroscience* (2003). This fallacy attributes the capacity or function to a part that can only be properly attributed to the combined total of which it is part. According to this view the psychological and moral attributes of individuals, such as responsibility, intention, and decision-making are not localised in the brain, but are perceptible through people’s behaviour during their lifetime.

Past techniques such as the polygraph and the P-300 MERMER used today share the common assumption that lying involves stable and detectable neurological correlates (Pardo & Patterson, 2011, p. 19). In all the cases cited above, the use of this technique has been made from this assumption and therefore from a materialist view of the mind. The application of this technique, from this perspective, incurs in the problems discussed above, that is, the confusion between the conceptual and the empirical, and consequently the mereological fallacy.

The attempt to detect lying with an EEG implies that humans store information in their brain, like a computer. In this case it would be unlikely to fail to recognise a visual or auditory stimulus, and variation in the brain-wave pattern would inform us whether it recognises it or not. Detecting lies with this and other techniques is controversial, however. Conceptually, the lie adheres to human behaviour and not to neurological evidence. At most, a piece of neuroscientific evidence could provide a link between the lying behaviour and a certain brain state, thus providing an inductive proof of a lie (Pardo & Patterson, 2011, p. 21), but it could never give a measure of lies (Monteleone et al., 2009). It would therefore be wrong to say that neuroscience has the potential to reveal the lies that occur in an area of the brain.

Instead of this materialist mind—localisationist and deterministic—perhaps another idea could help further the dialogue between neuroscience and law. This would be an idea which does not imply that the concept of the mind is necessarily measurable and physical. In fact the mind implies that human beings have a certain rationality which relates to thought, emotion and action. Its most immediate manifestation consists of a set of skills, abilities and competencies which obviously interact in the brain, but are not causally determined by it; rather, they emerge from it. The emergentist conception of the brain helps us to understand that the structures and human capacities are irreducible to the properties of its components. It affirms the systematic development of new properties. In the case of humans these are transcendental properties (liberty, responsibility, intentionality among others) because they allow us to go beyond the average of any other animal species and become human life itself. These capabilities arise from the processes of neural activity, but may not be limited to them only.

When the emergentist mind is taken as a starting point, the expectations of the contributions neuroscience can make to the law will be considerably reduced. A power that is not justified is therefore not granted. However, we are not saying here that neuroscience has nothing to say to the law. Neural structures are obviously necessary in the study of human capabilities, and neuroscience can help to describe their operations, but not the skills base and human behaviour arising from them.

CONCLUSIONS

The six cases presented refer to three types of proceedings in which evidence using neuroimaging techniques and electroencephalograms have been considered in very different ways. The two US cases refer to the direct acceptance of Brain Fingerprinting or P300-MERMER as direct exonerative and incriminating evidence. The two Spanish cases refer to the indirect and secondary acceptance of the P300-MERMER as evidence in criminal cases. This technique was also used as an investigative tool to find the victims' bodies. Finally, the two Italian cases show the disparity in interpretations of the same functional neuroimages in the debate over free will and conscious decision-making ability.

The six cases analysed show that neuroimaging techniques and their results have been accepted as evidence in judicial proceedings on various occasions. While up to this point there have been no changes to the judicial system—something that Greene and Cohen in fact seek—this type of evidence has been used to incriminate or exonerate alleged criminals. In our opinion, the use of electroencephalograms or neuroimaging can be useful as complementary evidence in an investigation but will create very negative moral consequences if used as primary evidence in sentencing. As noted by Vincent, before being used in any capacity, a unified neuroscientific concept of responsibility is needed, as well as an awareness of the implications of the use of these techniques.

There is a logical and moral limitation to the use of these techniques because an individual cannot completely share the experience of another without becoming that person. This distinction introduces a filter, an interpretation that individualises respective points of view. In other words, by virtue of our separateness, we have a private room that cannot logically be violated: the room of our mind. The presence of this logical limitation does not say anything about the expanse of our private life, unless it is non-existent. It also does not mean that our inalienable intimacy cannot be extremely small. However, it does not imply that we should not have privileged access to our experiences: the fact that there is an essential deficiency in whatever knowledge one person can have about another does not mean that there must be a deficiency in one's own self-understanding. On the contrary, these techniques suggest that a neuroimage or electric wave variation in the brain could provide more information about a subject than can be obtained from simple argumentative introspection. The use of these techniques to condemn or exonerate an alleged criminal is, at the very least, dangerous.

If there comes a moment in which the use of neuroscientific evidence becomes generalised in criminal proceedings, we will confront a new form of "neuropower". In the context of neurolaw, interpretations from the scientific community of supposedly empirical and objective results would take precedence over discursive arguments in judicial proceedings to determine free will, responsibility, and even human liberty. What would then be the difference between a society that prefers to directly attack the capacity for making decisions even before they are made and a society that uses neurotechnology *a posteriori* to determine whether a decision was made consciously and freely? Free will in people's decision making cannot be omitted or eliminated by the weight of other variables as neuroimaging evidence.

Finally, an emergentist point of view is less problematic than the reductionist materialist viewpoint because has fewer limitations. It is certainly problematic that neuroscience tells us what the brain thinks, believes, feels or intends to do, because it is people who have these capabilities. These capabilities arise from neural processes, but cannot be confined to them. The neural activity is necessary but not sufficient. As M. Gazzaniga (2011, pp. 217-219) noted in this regard, people make an abstraction that occurs when a mind emerges from the brain, and it interacts with the living environment. This abstraction is what provides the transcendental moment in the human dimension, and makes us human beings—we would add ethical human beings—and not governed solely by the laws of nature.

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