

The brain in the courtroom

## الدماغ في قاعة المحكمة

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## الملخص:

إن التطورات الحديثة في علم الأعصاب توفر للقضاة أدوات جديدة لكشف الحقيقة وتطبيق القانون. فبعيداً عن مجالات الطب والرعاية، بدأ علم الأعصاب يتجاوز جدران قاعة المحكمة. والآن يسعى القياس القضائي إلى الجمع بين العالمية والحياد على أساس المعرفة المنطقية والعلمية. والآن أصبح التفاعل بين كل المساهمات التي قدمها علم الأعصاب مطلوباً بشدة فيما يتصل بالقانون الإجرائي. ولكن يبدو أن هذه المفاهيم وهذه الأدوات لا تعترف بالبحث عن الحقيقة العلمية فحسب، بل إنها تمنحنا أيضاً ممارسة أشكال من العمل من شأنها أن تنتهك خصوصية الفكر. إن صعود العلم الشرعي أمر ضروري، ولكن لا بد أن يكون جزءاً من الاستخدام الصحي للمعرفة، لأن علم الأعصاب يقدم لنا مصطلحات عن العمل تؤثر على سلوك الفرد وتصرفاته.

الكلمات المفتاحية: الدماغ، قاعة المحكمة.

## Abstract

Recent advances in brain science are providing judges with new tools for uncovering the truth and applying the law. Beyond the realms of medicine and care, neuroscience is beginning to reach beyond the walls of the courtroom. The judicial syllogism is now seeking to combine universality and neutrality based on logical and scientific knowledge. The interaction of all the contributions made by neuroscience is now in great demand with regard to procedural law. However, it seems that these conceptions and these tools not only admit the search for scientific truth but also confer the exercise of modalities of action that can infringe on the intimacy of thought. The rise of forensic scientism is imperative, but it must be part of a healthy use of knowledge, since neuroscience offers us a jargon of actions on the behavior and conduct of the individual.

**Keywords:** brain, courtroom.

## **Introduction:**

The interplay between law and neuroscience has led to the study of the interdisciplinary field of law and the brain<sup>1</sup>. The brain's influence on human behavior is undeniable, prompting the scientific community to focus on understanding brain functions and leveraging new technologies to make significant discoveries. Neuroscience, which gained momentum in the 1990s and is often referred to as the "decade of the brain,"<sup>2</sup> is a dynamic and promising field within biology. It introduces new concepts<sup>3</sup> that offer valuable insights into personal health conditions.

This is a problem that arises whenever scientific progress takes hold of judicial power, insofar as "progress, a goal constantly displaced, or a stage always renewed, has changes of perspective, it is the Ideal point. Reveals, then, the mutability of science, which is always seeking perpetual motion, what has found it on itself"<sup>4</sup>. It's a challenge to old prerequisites that can only lead to the emergence of a new law in harmony with the scientific progress that has given birth to Neurolaw.

For judges, it becomes essential to have knowledge of these scientific facts in order to effectively apply the law. However, this integration of scientific progress into legal decision-making poses a challenge as the ever-evolving nature of science continually reshapes our understanding. As science seeks progress, it questions traditional assumptions and necessitates the development of new laws that align with the advancements in neuroscience, leading to the emergence of neurolaw.

No one can deny today that the biological evolution, having brought about the metamorphosis of modern society, is no longer a miracle of civilization. It is, however, cultural evolution, and an inescapable result of the evolution of science. They are constantly changing, modifying the concepts that surround the notion of the brain and its consistency.

In addition to its emblematic status and in the absence of any antagonism, the brain maintains a relationship of complementarity and mutual aid with the law. It calls on the brain

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<sup>1</sup> Menei Ph and Dworzak F., "cerveau et droit, impact des neurosciences sur le droit, aujourd'hui et demain", l'Harmattan 2023, p 13.

<sup>2</sup> CHNEIWEISS H., "Huxley, propète de la modernité. des cerveaux libres et heureux", Paris: Alvik, 2006, p.11.

<sup>3</sup> Dalbignat - Deharo G., "Vérité scientifique et vérité judiciaire en droit privé", pref. L. Cadiet, LGDJ, Bibliothèque de l'institut André Tunc, 2004, n° 92, p 88.

<sup>4</sup> Hugo V. "l'art et la science", Actes sud.

sciences to bring new approaches to legal science. Scientific truth thus appears to be the essential factor in legitimizing a judicial decision, and neuroscience is now an emerging evidentiary tool (I). However, the scope of application of neuroscience is limited by a number of interactions, as scientific truth encounters obstacles that result in the termination of the emerging field (II).

### **I. Neuroscience: A Newly Emerging Field**

The neurosciences contribute to the study of the nervous system, with a particular focus on the brain. The brain develops throughout childhood and adolescence, reaching maturity at a certain point in this developmental period.

The intricate complexity and architectural structure of the nervous system have long held the attention of scientists, who have sought to understand its fundamental underpinnings and their role in enabling the materialisation and circulation of information. Consequently, they regulate the entire nervous system.

It is noteworthy that the assessment of an offender's dangerousness may be conducted using neuroscientific methods, specifically medical imaging. Consequently, a magnetic resonance imaging (MRI) scan, whether functional or anatomical, has long been able to confirm the absence of an emotional center in the brain. However, dynamic neural networks are responsible for the different emotions and behaviors, which interact as *"the key to learning processes, social behavior, neurological and mental dysfunctions"*<sup>5</sup>. They bring together all the disciplines that deal with neurosurgery, neurophysiology, neuropharmacology, neuroendocrinology, neurogenetics and neuroimaging. In fact, they act at the molecular, cellular, neuronal and behavioral levels.

The use of an electroencephalogram<sup>6</sup> would facilitate the discernment of whether the criminal was genuinely acting under the influence of a mental disorder that had abolished his discernment, or whether he was acting intentionally and with full knowledge of the facts. These

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<sup>5</sup> Byk Ch, "Responsabilité et dangerosité à l'aune des neurosciences", RPDP 2010, p. 325

<sup>6</sup> This is an EEG which records a trace of cerebral activity, making it possible to measure the variations in the magnetic field induced by the electrical activity of the neurons. Fiori-Duharcourt N and Isel F, "les neurosciences cognitives", coll. Cursus. Armand collin. p. 53.

techniques, which rely on the judge's discretion, will facilitate the ascertainment of the "true" facts<sup>7</sup>.

The acceleration and development of the sciences are contributing to the emergence of new neuronal disciplines that are making their way beyond the laboratory. These developments are leading towards a revitalization of biology and a hoped-for rational process (A), as well as ethical and legal conceptions (B) of our lives. The objective is to establish a neurolaw.

### **A. The rational process of establishing judicial truth**

Discussing the concept of truth in the context of the law is, in essence, a discussion about evidence presented in a court of law. In this sense, legal truth manifested as oral evidence, particularly confessions, which were once regarded as the epitome of testimony. Conversely, the notion of legal truth became increasingly challenging to define, particularly in comparison to the advancements observed in the scientific domain. It has established a presumption of doubt regarding the legal status of sound speech. In this regard, the legislator was compelled to acknowledge the veracity of testimony. In the present era, evidence is founded upon the indispensable illumination that illuminates the legal horizon. It is the component that establishes the veracity of a proposition<sup>8</sup>. Proof is defined as that which persuades the mind of a truth. The term "legal proof" is used to describe the procedures set forth in legislation for the discovery and establishment of the truth of a disputed fact<sup>9</sup> with evidence. This methodology provides a relatively clear framework for understanding the judicial society's need for truth and the fairness of criminal trials. This presupposes the existence of an offence and the presumption of guilt of the individual who has been prosecuted for that offence. Neuro-proof, with its advantageous innovations (a), is then introduced with the objective of achieving the certainty of the offence

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<sup>7</sup> BENEZECH M , " Intime conviction : conclusions " . Annales Médico - Psychologiques 2015 . vol . 173, p. 636: "For the time being, the 'true' truth remains resolutely inaccessible to human justice, and doubt does not always benefit the person being judged. Truth lies at the bottom of the abyss, wrote Democritus; let us hope that neuroscience will one day help it to rise to the surface.

<sup>8</sup> Lagneau Ch, "De l'expertise à la base scientifique comme moyen de preuve en matière criminelle", Paris, Domat-Montchrestien, 1934, p.14.

<sup>9</sup> DOMAT , "Civil laws in their natural order ( 1689-1694 )" Oeuvres complètes de J. Domat par J. Rémy , 1828 , Première partie , L. III , Tit . VI, p. 137 and 141. Bibliography: E. VERGES , G. VIAL and O. LECLERC, "Droit de la preuve" , PUF , 2015 ; X. LAGARDE , "Réflexions critiques sur le droit de la preuve", LGDJ , 1994 le droit de la preuve n'aurait pas pour objet l'établissement de la vérité ; La preuve " , dir . Cath . Puigelier , Economica , 2004 ; " La preuve " , Revue de droit Henri Capitant 2013 , n ° 6 , pp . 1 à 235.- On the modifications introduced by ordinance n ° 2016-131 of 10 February 2016 reforming contract law : dossier Réforme du droit de la preuve , Dr. et patr . Sept. 2015 , p . 36 ; chron , G. LARDEUX , D. 2016 , 850 ; chron . E. VERGES , JCP.G 2016 , 486 and JCP.G 2017 , 510 .

and the certainty of the guilt of the convicted person. In a sense, it facilitates the expression of information by the brain (b).

### **a. Neuro-proofs: Innovations in Scientific Proof**

The concept of proof in law can be considered a subset of the broader field of scientific proof. Such utilization in judicial decisions would give rise to a "hybrid" subject, situated on the borderline between the formal regularity of judicial reasoning and scientific demonstration<sup>10</sup>. The scientific paradigm encourages the exercise of jurisdictional activity within a framework of uncertainty that pervades the trial and procedure. Indeed, the administration of evidence serves to confirm the establishment of just and fair legal proceedings, which are the indispensable foundation of the legal order. The question thus arises as to what evidence we are required to persuade. What is the nature of the truth in question? How can accountability for actions be established?

It is necessary to provide clarification regarding the concept of evidence<sup>11</sup> in order to persuade the judge. The art of procedure is concerned with the administration of evidence. Given the inherent unreliability of witnesses, it falls upon the judge to call upon the expertise of an impartial third party. The latter furnishes him with the requisite knowledge to respond to questions that can only be answered by virtue of his expertise.

For some individuals, the act of judging is synonymous with a lack of comprehension. This is because the capacity to judge<sup>12</sup> is inherently linked to the inability to fully grasp a situation or concept. Conversely, for others, it signifies an attempt to comprehend, when the two concepts are synthesized. It is evident that a compromise exists between the realms of law and science, given that each requires the other for its own sustenance. Similarly, *science requires the protection of the law and the legitimacy that society affords it. Conversely, the law necessitates the support of science to elucidate truths and, in turn, to confer legitimacy<sup>13</sup> upon its judgments. In this sense, the scientific expert appraisal provides a language that is inherently comprehensible to both the scientist and the judge.* The application of scientific technics enables

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<sup>10</sup> Encinas De Munagorri R, "Is the scientific community a legal order", RDT. civ. 1998, p. 251.

<sup>11</sup> Bentham J, "Traité des preuves judiciaires", Paris, Bossages frères, 1823. p.3.

<sup>12</sup> Les conquérants, Malraux A, Grasset, 1928.

<sup>13</sup> Fezzani F. "les neurosciences en tant que moyen de preuve, ou les implications juridiques de l'utilisation judiciaire des neurosciences", pref. Pizzio-Delaporte C, th. univ. Paris II, 6 Apr 2019. éd mare & mare, 2021.p.37

the establishment of a balance between power and knowledge, as they provide a foundation of certainty within the judicial process. Furthermore, they constitute a factor of innovation and revolution in the trial process.

The advent of neuroscience within the judicial system was not so much an addition to the existing body of knowledge as a necessary consequence of its own evolution. In accordance with the rational order of the law and specific criteria within a field where silent, yet material and reliable witnesses cannot and do not lie<sup>14</sup>, such evidence is required.

The ability to discern the contents of another person's mind is now a valid means of proof in all fields. Such technics may be employed in the legal and judicial systems through the utilization of brain imaging methods. Conversely, the interconnection between neuroscience and the legal field is not a novel phenomenon. For a considerable period of time, criminologists have established a correlation between criminal phenomena and abnormalities in the brain. Subsequently, sociological, technological and economic changes have resulted in an increase in social distancing. In particular, it affects legal norms in the context of the post-pandemic era. Furthermore, the influence of a paradigm that is particularly evident in contemporary institutions has resulted in a significant transformation in individual subjectivity and brain activation. In this regard, a nuanced comprehension of the human brain is imperative. It is a dynamic organ that undergoes transformation in response to the body's physiological processes. It is distinguished by two hemispheres: the right hemisphere, which is associated with emotional and intuitive processing, and the left hemisphere, which is linked to logical and sequential processing<sup>15</sup>. The nervous system can be conceptualized as a central processing unit, comprising the brain and the spinal cord. The spinal cord serves as an integration center, analyzing and interpreting sensory information.

The nervous system is responsible for the transmission and reception of electrical signals, which are conducted via channels to specific peripheral structures. In this regard, it encompasses the entire network of remaining nerves. In other words, both the cranial nerves

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<sup>14</sup> Lagneau Ch, "De l'expertise à la base scientifique comme moyen de preuve en matière criminelle", op.cit, p.33

<sup>15</sup> the two hemispheres are made up of four lobes: the frontal lobe, the parietal lobe, the temporal lobe and the occipital lobe

(attached to the brain stem) and the spinal nerves (attached to the spinal cord<sup>16</sup>) are part of the peripheral nervous system.

The criminal acts of criminals should be rigorously interpreted. Neuroscience has no hesitation in fulfilling this mission through neuroimaging technics, whether it is structural; to identify and detect brain lesions for surgical intervention, a cognitive neuroscience research, or maybe functional, to assess neuronal activity. Mr Bihan was studying mental imagery, which made it possible to see the visual activation of the primary visual cortex around the "Calcarine scissor" using real images. Various technics were also used to obtain information about brain activity in response, and thus to observe and explain the criminal phenomenon.

Neuroscience, therefore, in conjunction with other disciplines, makes it possible to study behavior and identify the characteristic features of certain anomalies in individuals compared with others. Criminologists are therefore relegating certain methods to the background in the face of the emergence of brain sciences. It is therefore a question of a genuine understanding between the facts and circumstances of the offence, which serves the legal reality of "proof".

#### **a- The brain in deliberation?**

In legal language, **truth** is "*that which is designated by law, that which conforms to law and that which conforms to moral truth*"<sup>17</sup>. For the purposes of this study, the psychological, sociological and, more recently, cognitive sciences, known more broadly as "NBIC"<sup>18</sup>, were used to make the brain speak in the courts. Neuroscience is now at the heart of trials and proceedings, to ensure that justice is properly understood and administered. In this respect, they are highlighting the close links between law and science and technology in the form of neuro-law. Today, "*the means of seeking and gathering evidence have been significantly modified*"<sup>19</sup>. As a result, we are implementing a new stage in the scientification of law, in which the neuroscientific brain revolution is emerging, thus abdicating traditional conceptions of evidence. It is not so much emancipation as a constraint imposed by progress in the functioning of the nervous system. Admittedly, an undeniable circumscription of the nature of the administration and effects of neuroscientific evidence should, necessarily, be

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<sup>16</sup> Thomasset L., "La neuroéthique saisie par le droit, contribution à l'élaboration d'un droit des neuro-technologies", pref. Fabre-Magnan M, th. 7 déc 2021, éd. Dalloz 2023, IRJS. n°2, p. 2

<sup>17</sup> Cornu. G, "Traité de droit civil, introduction générale", 4th ed, n°628.

<sup>18</sup> Nanotechnologies, Biotechnologies, Computing and Cognitive Sciences)

<sup>19</sup> Ambroise-Casterot C, "Recherche et administration des preuves en procédure pénale: la quête de la Graal de la vérité", AJ Pénal, 2005, p. 261.



apprehended, in order to grasp the regime of practices from which it is admitted.

*"The spectacular biological discoveries of the last hundred years will surely be followed by many others. It is to be hoped that mankind will be able to make the best use of them. The task of assisting justice in the revelation of the truth is undoubtedly one of the noblest"*<sup>20</sup> had stated Nicole Le Douarin. So we're talking about the security of neuroscientific evidence. After lengthy scientific advances, public notoriety was relied upon first, followed by the confession, the royal proof, as evidence of the guilt of the accused. Secondly, the strength of the evidence was acquired through a written document issued by the parties, whose witness evidence was no longer admissible. This was literal proof or proof par excellence, reinforced by morality. This led to the emergence of scientific evidence, and more specifically, indexical evidence. Today, forensic science is referred to as *"processes aimed at understanding the mechanisms of crime with a view to identifying the parties involved, through the search for, collection and scientific exploitation of crime clues"*<sup>21</sup> .

The modern era is inescapably based on neuroscientific evidence. It covers all data capable of revealing the information that can be processed by the brain. This is cognitive neuroscience, an explanation of how the various systems work<sup>22</sup> and the contribution of individual behavior to decision-making, mainly in the legal field.

Today there is no question of brain imaging to identify a lesion. Rather, it is a matter of reading and accessing the content of the thoughts of the perpetrator of an act or deed. It is based on neuronal activity, which encompasses will, intention, desire and feelings. It is therefore possible to detect the brain in the act of thinking. In this case, when an MRI scan is performed, the person is placed in an enormous magnetic field, which will orientate the magnetization of the protons in a certain direction. We then measure how these protons react to the magnetic field. The protons are measured differently depending on the tissue in which they are placed. This differentiation is used to recreate an anatomical image of the person concerned. This means that the activated zone reveals the increase in blood flow and oxygen at the moment when the subject is thinking.

Is it true that this is an emerging technique, with its full contribution to lie detection?

The Italian criminologist César Lombroso first recognized the importance of lying in the 19th

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<sup>20</sup> Extract from *La preuve scientifique* , Des empreintes digitales aux empreintes génétiques : un siècle de découvertes en biologie , by Nicole Le Douarin , in *La preuve* , by Catherine Puigelier ( dir.) , Economica , 2004

<sup>21</sup> Fombonne J, "la criminalistique", Paris, PUF, Que sais-je? 1996, p. 20.

<sup>22</sup> Including the sensory system, language, memory, perception, intelligence, emotions and reasoning,

century. He said that lying is accompanied by variations in blood pressure and an increase in heart rate. This concept was later developed by Ekman and O'Sullivan. According to them, a liar generally takes longer to answer questions, with a slower speech rate and shorter sentences than a non-liar.

In the 20th century, the polygraph or lie detector technique invaded the scientific and legal fields. This was a machine used by investigators during questioning to qualify the circumstances of an offence. At the same time, VSA (*voice, stress, analysis*) was subsequently introduced as part of the conclusions of the US congressional committee. The aim was to set up a research program for the US army to detect lies. The task was entrusted to Colonel Charles R. McQuiston, who coined the term VSA (*voice, stress, analysis*), later renamed PSE<sup>23</sup>. Other methods were successively developed. Charles Humble founded the National Institute for Truth Verification (NITV)<sup>24</sup>. To which he marketed his computer- assisted voice stress analysis system<sup>25</sup>. It was based on the existence of a micro tremor that can only be qualified by frequencies ranging from 8 to 12 Hz. The variation in these frequencies manifests an undulation of the vocal cords and the basic pitch of the voice. In this way, the condition of the person lying or telling the truth is persuaded. A scientific study recently developed and marketed by Nemesysco<sup>26</sup> uses layered voice analysis (*LVA*). However, none of the neuro-detection techniques cited was capable of accurately determining which subject was lying and which was telling the truth. In various decisions, these techniques have been declared inadmissible. The polygraph technique would make the confession appear similar to that obtained by torture, a principle that contradicts the freedom of confession.

In addition, the United States has used neuro-detection techniques to detect lies in legal cases. These include *Brain Fingerprinting*<sup>27</sup>, which is based on electroencephalograms and involves placing electrodes on the scalp to measure the brain's fingerprint. This is a truth test, based on the measurement of the P300 wave, which varies according to whether or not the brain had contact with the information recommended. In other words, private investigators could deduce the degree of familiarity of the information the person is hearing, by virtue of their spontaneous reactions, from the images scrolling across the computer screen. If the image

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<sup>23</sup> PSE: *Psychological Stress Evaluator*

<sup>24</sup> *National Institute of Truth Verification*

<sup>25</sup> CVSA or *Computerised Voice Stress Analysis*

<sup>26</sup> H. Hollien, J. D. Harnsberger, C. A. Martin and K. A. Hollien, Evaluation of the NITV CVSA, *Journal of forensic science* (2008), 53 (1), 183-193. K. R. Damphousse, L. Pointon, D. Upchurch & R. K. Moore, Assessing the validity of voice stress analysis tools in jail setting (June 2007). V. [www.nicic.org/Library/022419](http://www.nicic.org/Library/022419).

<sup>27</sup> Used in *Harrington vs State*, case n°PCCV 073247, Iowa (5 march 2001)

has already been seen by the suspect, the P300 wave registers its peak. It would therefore be impossible to deprive the judicial field of the neurodetection of lies as a means of proof, given its inherent epistemological usefulness in judicial decision-making.

### **B- Neuroscience: An undeniable epistemology for judicial decision-making**

It is curious to note that a judgment is simply a decision based on the assertion of knowledge. It is therefore clear that it is a matter of judicial truth. The judge can only decide if he knows the basis of the facts in full knowledge of the facts, so that the trial can be conducted fairly. It is a sort of inclination between the principle and the prohibition. The innovation of truth-telling imposed on the courts can only be applied through the innovation of neuroscience. Neuroscience is generating a neurolaw linked to the development of a system for managing scientific information. Judges cannot be content with abstract reasoning. His inner conviction is obviously based on a rational interpretation. This would enable him to legitimize his thinking with the help of neuroscience in order to give substance to legal logic and thus deliver justice more effectively. To achieve such a result, the judge usually has recourse to hiring a man of the art who could scientifically determine this indispensable truth. However, it is no longer a question of questioning the scientific nature of the law and the technical nature of the procedures, but it is even more a question of determining the scientific measures that can be invoked to qualify the dangerousness of the fact. Subsequently, a right of defense was instituted in order to neutralize the offence and establish, to a certain extent, the irresponsibility of its perpetrator (a) and the personalization of the criminal sanction (b). How, then, can we accept that neuroscience is capable of proving that an offender is not responsible? Is it true that brain imaging is used to declare the responsibility or irresponsibility of a subject of law? Could neuroscience reduce the severity of a penalty? Is this not a restriction on the judge's free will? Aren't the brain sciences competitors in the courtroom?

#### **a- Neurosciences: a new tool in the fight against criminal irresponsibility**

Deciding whether an accused person is guilty is no more difficult. The classification of his imputability lies at the heart of the effectiveness of his rights of defense. Whether or not the interest of this classification, establishing his guilt or not, is in perfect harmony with the spirit of the principle of the rule of law, no one can dispute. *To speak of truth in law is first and foremost to speak of evidence in a trial*<sup>28</sup>. On the other hand, there seems to be a difference in purpose that stems from the credit, greater or lesser, given to the quality of the evidence. They are part of scientific statements and the imperatives of legal deliberation.

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<sup>28</sup> De Leval. G, "la preuve et la difficile quête de la vérité judiciaire", Anthémis, Liège, CUP, 2011, p. 285

Through both of that, we gain access to the communicational theory of justice<sup>29</sup>. In other words, a jurisdiction what is open to the scientific environment, a communicative arrangement between legitimacy and scientific practice. By hypothesis, law and science maintain an interactive relationship, mainly during psychiatric and psychological assessments. As a result, certain actions liable to overturn the very principle of responsibility for the commission of an offence, or to reveal a lack of culpability, are annihilated. The first significant indication of this relationship is mental illness.

The criminal law is the first, by virtue of its provisions, to retain the rights of a person suffering from a mental disorder. However, this disorder must exist at the time of the crime and must be established by a medical expert as set out in article 75 of the Criminal Code. Under this provision, circumstances prior to or subsequent to the crime or offence that evoke a loss of control over one's actions are not sufficient grounds for invoking the accused's lack of responsibility.

Certainly, the requirement of medical justification in order to implement the action seems particularly important, since it affects the law in its repressive dimension and makes it possible to institute a cause of irresponsibility. It is therefore a question of evidence that undeniably takes on a scientific dimension that supports the representation of the judgment. It is important to note, moreover, that in order to be fully effective, scientific evidence must incorporate scientific knowledge. It calls for new skills and new technical procedures that are enriched by methods of biological investigation and psychic singularity. They thus constitute the cerebral information of the subject of law. It is quite clear that psychiatric expertise would allow medical experts to establish or abolish the incrimination and guilt of the accused and, once again, to engage his responsibility. The Moroccan legislator decided to use a broader concept, "**disorders of mental faculties**". The principle is therefore one of total irresponsibility, prohibiting prosecution and conviction. Despite this apparent convenience, neuronal proof remains extremely difficult. This is the dividing line between neurology, psychology and criminology. Criminal behavior linked to a cerebral anomaly would therefore be envisaged in order to establish the guilt or innocence of the perpetrator by means of an expert assessment using cerebral imaging. Neuropsychological studies have shown a distinction in the brightness of a brain area in people with the greatest psychological bias and those without. This is particularly true of the study carried out by Elizabeth Stuart Phelps<sup>30</sup>.

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<sup>29</sup> Habermas, J, "le juge entre le progrès scientifique et mondialisation", RTD civ., n°1, 2005, pp. 33-46

<sup>30</sup> Professor at *New York University*

and Tali Sharot<sup>31</sup> on optimists and those suffering from depression. Tests using functional magnetic resonance imaging were carried out on these people, showing inactivity of the Rostral Anterior Cingulate Cortex (RACC) in those suffering from depression. Psychopaths consequently have a volume of the cerebral amygdala reduced by around 20% compared with healthy individuals. This technique makes it possible to collect a series of data on the brain that may or may not engage the responsibility of the legal subject. However, to date, the use of brain imaging as legal evidence in Morocco has never been implemented, insofar as there appears to be certain reluctance on the part of the legislator with regard to such a technique.

### **b- Using neuroscience to personalize sentences**

"It is of little value to frighten the wicked by punishment, if they are not made better by discipline"<sup>32</sup>. If, then, punishment is the means by which the perpetrator is punished, then punishment in criminal law is nothing more than the expression of society's will to repress criminal behaviour. Unquestionably, the inclusion of penalties in criminal policy has undergone profound changes over time. On the one hand, the concept of delinquency and, on the other, the human rights perspective, which consists of replacing aggravating penalties with mitigating circumstances for certain offences. This raises the question of the personalization of penalties, since culpable behavior varies from one person to another, depending on their personality. Identical penalties cannot be applied to all individuals. Initially, the social pact gave rise to the retributive function. It requires less of a utilitarian conception and more of a moral one, and is closer to the restorative function. Derived from private vengeance, punishment remained symbolically linked to payment of the debt owed to the wrongdoer and to society. Anglo-American criminal law then took a further step in this direction, by making punishment proportionate to the blameworthy or criminal acts. It was based on the theory of utilitarianism, a concept that seeks to rehabilitate and educate the guilty party, making him useful to society. This approach indicates a metamorphosis in the repression of offences, in other words, it is, first and foremost, instituting and applying a dualism between repressive criminal law and preventive criminal law. Referred to by Ms Poncela as "*redemptions in the service of social utility*"<sup>33</sup>, this is an objection to deterring offenders from carrying out their acts, given the seriousness of the penalty incurred in the event of a repeat offence. Secondly, the aim is to isolate offenders from society to prevent them from committing further offences.

In other words, to promote custodial sentences through imprisonment or legal

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<sup>31</sup> Professor at University College London

<sup>32</sup> This motto was inscribed on the prison of Saint Michael in Rome in 1703 by Pope Clement XI

<sup>33</sup> P. Poncela, "Eclipses et réapparitions de la rétribution en droit pénal", in *Rétribution et Justice pénale*, PUF, 1983, p. 13.

prohibition, designed to establish a sort of selection between the various degrees of dangerousness of delinquency by means of what is known as "selective neutralization" <sup>34</sup>.

The use of this approach reflects a desire to find the ideal balance between punishment and rehabilitation in order to prevent repeat offending. Indeed, it is only through the reaction of society and the law, to apply criminal sanctions adapted to each conduct, that a certain balance is established, taking into account the circumstances of each offence and the person of its perpetrator. Under these conditions, and over and above any repercussions that might result from a readjustment of the penalties for the offences committed, how can we assess an individual's dangerousness from the point of view of care in order, in fine, to qualify the appropriate sentence? How is psychiatric dangerousness likely to affect the principle of individuality in sentencing?

In order to measure the degree of psychiatric dangerousness of an individual, it would be appropriate to take into account the existence of an anomaly linked to a cerebral dysfunction. This would be all the more useful as it would corroborate, support, reinforce and shed light on the existence of a serious personality disorder exempting the subject from a conviction. Moreover, it is important to make it clear that the use of brain imaging techniques is not immune from new perspectives that contribute greatly to obtaining sentence adjustments. This means "assessing the risk of dangerousness and recidivism in the clinical course of the pathology identified in the patient"<sup>35</sup>. We must now assume that various cognitive neuroscience and neuro-anatomy techniques are used for brain self-modulation. Deep brain stimulation is also prescribed to treat certain diseases. Electromagnetic stimulation of the prefrontal cortex is capable of eliminating secretive attitudes and activating certain aspects of social cognition in such a way as to act on the brain area concerned. This means that a new form of cerebral organization is figuratively being founded making the brain talk without, however, providing for an investigation to make the subject confess. All this complexity does not exclude the danger of interrupting the development of the embryo.

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<sup>34</sup> Bergel J-L, "une problématique des sanctions pénales", Mélanges offerts à Gassin. R, sc.pé.& crim, pref. Cimamonti.S. Di- Marino. G. Lassalle. J-Y, ISPEC, CRMP, P. 90

<sup>35</sup> Fédération française de psychiatrie, "l'expertise psychiatrique pénale", Recommandations de la commission d'audition, 2007.

## **I - Neuroscience: an interrupted embryo**

The scientific revolution in the brain has led to an upheaval in conceptions of life. It concerns human's intimate relationship with science. Very logically, Hippocrates wrote: *"Human should know that joy, pleasure, laughter and amusement, sorrow, grief, discouragement and tears can only come from the brain. This is how, in a singular way, we acquire wisdom and knowledge, we can see and hear, appreciate what is intelligent and what is foolish, what is good and what is evil, what is sweet and what is tasteless... it is because of the same organ that we can become mad and demented and that fear and anguish assail us... All this happens when the brain is sick... I therefore consider that the brain exercises the greatest power over human"*.<sup>36</sup> It's true that with the complexity of data and the evolution of scientific knowledge, the physiology of the brain has been greatly intrigued by the development of new behaviors. These emerge from neuronal networks that allow the brain to develop. It thus obeys decision centers that govern our nervous activity as well as our social behavior. Weaving the relationship between cognition and normativity risks undermining technical and scientific concepts (B) as well as legal concepts (A) such as the freedom and dignity of the human person. In other words, isn't our free will affected by access to the black box? Doesn't neuroscience jeopardize the privacy of our thoughts and our identity through the manipulation and sharing of neuronal information?

### **A- Legal interruption**

Clearly, the importance of the brain sciences is well known. Their social weight would favor their transposition within contemporary societies and contribute to the development of multidisciplinary research using scientific concepts appropriate to each individual. Centered on the brain, neuroscience legitimately crosses the range of neuroscientific explanations that give rise to the personal identity specific to each human species.

Neuro-ethics manifests its pure and simple abdication with regard to the legalization of moral data produced by neuroscience. In fact, it is a kind of deciphering of the intimate part inherent in making the black box transparent, which inevitably means infringing individual freedoms and fundamental rights, generating a conflict of values and consequently running the risk of infringing privacy (a) and freedom of evidence (b).

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<sup>36</sup> Hippocrate, *la maladie sacrée*", établi. trad., Jouanna. J.



## **a- Substantive law: risk of infringement of the principle of human dignity and integrity**

If the brain is capable of determining every thought and every cognitive function (knowledge, activities and cerebral maturity), isn't it time to protect them from any invasion of privacy by virtue of the formula "I (the subject, person or individual) am my brain?"<sup>37</sup>

Going from a principle of respecting the individual rights who are suffering from mental disorders; the article 3 of law 71-13<sup>38</sup> is clearly stating in favor of a system that protects their express, free and informed consent. It states that in order to protect their privacy, the preservation, discretion and confidentiality of their information is required against any attack that might be made upon it. There is no doubt that the brain imaging data is personal data, in accordance with Article 1 of Law 09-08 on the protection of individuals with regard to the processing of personal data, which defines personal data as "any information of any kind whatsoever and regardless of its medium, including sound and image, concerning an identified or identifiable natural person. An identifiable person is one who can be identified, directly or indirectly, in particular by reference to an identification number or to one or more factors specific to his or her physical, physiological, genetic, mental, economic, cultural or social identity". It is therefore the criterion of identification of the data subject that determines the personal data. On the other hand, the process may subsequently be rendered anonymous in order to "irreversibly prevent any identification"<sup>39</sup>. In addition, Title II of Law 71-13<sup>40</sup> deals with the rights that these people must enjoy without discrimination. It sets out the civil, political, economic, social, cultural and environmental rights and freedoms recognized to all citizens for the protection of the health, safety and public morals of all persons concerned.

In particular, the Declaration of the Rights of Mentally Retarded Persons adopted in 1971 by the General Assembly of the United Nations stipulates that "mentally retarded persons should,

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<sup>37</sup>EHRENBERG A, "Se définir par son cerveau", *Esprit*, January 2015, p. 68-81; FOREST (Denis), *Neurosepticisme*, Editions Ithaque, Paris, 2014; ILLES (Judy), SAHAKIAN (Barbara J.), eds. *The Oxford Handbook of Neuroethics*, Oxford University Press, New York, 2011, p. 151-226

<sup>38</sup> Law 71-13 on combating mental disorders and protecting the rights of people suffering from such disorders

<sup>39</sup>G29, Opinion 05/2014 on anonymisation techniques, 10 April 2014, p. 3. Often confused with anonymisation, pseudonymisation is a different technique since it consists of "processing personal data in such a way that they cannot be attributed to a specific data subject without recourse to additional information, provided that this additional information is kept separately and is subject to technical and organisational measures to ensure that the personal data are not attributed to an identified or identifiable natural person". Article 4(5) of the General Data Protection Regulation (EU). The CNIL considers that pseudonymisation is equivalent to "reversible anonymisation". CNIL, "Fiche n° 16 L'anonymisation", in *Guide - La sécurité des données personnelles*, 2010, p. 38.

<sup>40</sup> Law 71-13 on combating mental disorders and protecting the rights of people suffering from such disorders.



as far as possible, enjoy the same rights as other human beings"<sup>41</sup> . According to article 4 of the Declaration of the Human Rights and Citizens of 26 August 1789, freedom "consists in being able to do everything that does not harm others; its limits can only be determined by the law". Consequently, it is up to the law, and the law alone, to domesticate the sciences in accordance with the principles of human value.

The concept of dignity was given legal recognition in international criminal law with the Charter of the United Nations signed in San Francisco on 26 June 1945. In its preamble, the United Nations reaffirmed its belief in fundamental human rights and in the dignity and worth of the human person.

Despite their great interest, contemporary research seems to be a dangerous departure from the principles of bioethics. One example is the process of neuro-modulation, the aim of which is to artificially modify a person's brain activity. These are clinical applications that are carried out either through interventions and electrical brain stimulation devices that modulate the functioning of the brain, or through medical techniques, i.e. "Magnetic Resonance Cerebral Imaging". Neuro-modulation can also be achieved using drugs such as Madopar, used to treat Parkinson's disease. A pathology responsible for the degeneration of dopaminergic neurons, for which it remedies the lack of dopamine by degenerating normal motor skills. On the other hand, the mechanism of neuro-improvement consists, according to the French language dictionaries, in making people better. The masculine adjective refers to the "comparative of superiority of good", to "that which is of greater quality"<sup>42</sup> , and implies the use of neuro-technology. In this sense, "psycho-affective and cognitive functioning can be improved, for example, by reducing anxiety or by attenuating the emotional charge of certain traumatic memories"<sup>43</sup> . It should be pointed out that this is a non-pathological state, which can be achieved by "drugs developed to improve intellectual functions, in particular memory and attention, as well as certain vegetative functions such as appetite and sleep. These molecules were originally developed to combat often serious illnesses, before their use shifted

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<sup>41</sup> Declaration of the Rights of Mentally Retarded Persons adopted by the UN on 20 December 1971 ( resolution 2856 ( XXVI ) , 20 Dec . 1971 , in Human Rights , collections of international instruments of the United Nations , New York , 1978 , pp . 131-138 )

<sup>42</sup> Dictionary of the French language, le Robert

<sup>43</sup> Comité Consultatif National d'Éthique, "Recours aux techniques biomédicales en vue de "neuro-amélioration" chez la personne non malade : enjeux éthiques", Opinion n°122, 2013. p.2.

to new syndromes with questionable and contested pathophysiological bases, and then to absolutely normal people"<sup>44</sup> .

All these technics, whether medicated or electric-magnetic, give rise to fears and should be regulated and their use restricted insofar as they undermine the integrity of the human body and invite neuro-determination: "Human's threats do not come primarily from potentially lethal machines, or from the technological apparatus. The real threats have always affected human in his essence"<sup>45</sup>. Expressly, once it comes to the tools of evidence that are indispensable to justice.

### **b- Procedural law: Risk of infringement of freedom of evidence**

In addition to the dignity and integrity of the human person, questions arise in the name of neuro-evidence in a trial.

The principle of freedom of evidence recognizes that there is no hierarchy between the different types of evidence that may be adduced by any means. In other words, the principle implies the amplification of evidentiary formalism insofar as the parties remain free to produce any type of evidence they wish. The administration of neuro-evidence cannot be required to the detriment of other evidence before the courts, which are free to assess its probative value. Nevertheless, "*In the whole theory of evidence, the solutions, insofar as they are isolated from the technical devices that clothe or transform them, have their roots in the pure necessity of things, in that real given of human and social life which brutally imposes itself on all wills*"<sup>46</sup> . The orders issued by those involved in criminal trials undeniably overturn the probative value of the freedom of evidence. Never before have the elements of proof been so demanding and required with such rigor. For Carnelutti, "proving does not mean demonstrating the truth of the disputed facts, but rather it means formally determining or fixing the facts by means of various procedures. It is no longer a search for material truth but a process of formally fixing the facts"<sup>47</sup>. Essentially the assimilation of a given act to a precise and well-defined misdemeanor or felony, the justice system must then seek out the perpetrator or provide proof of the suspect's responsibility or lack of responsibility. However, the integration of scientific information at the heart of the courts has developed fully in line with procedural data. The complication of scientific data and the concordance of the fairness

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<sup>44</sup> Chneiweiss H, "neurosciences et neuroéthique: des cerveaux libres et heureux", Paris: Alvik, 2006. p.51.

<sup>45</sup> Heidegger M, "la question de la technique" Basic Writing, New York: Harper and Row, 1957, P. 308.

<sup>46</sup> Gény F, "Science et technique en droit privé positif: nouvelle contribution à la critique de la méthode juridique", Tome II, Sirey, Paris, 1915 n° 167, p. 375

<sup>47</sup> Quoted in Ferrer Beltrán J, "La valoración de la prueba" Madrid, Marcial Pons, 2007, pp. 24-25.

of evidence seem to legitimize the intervention of neuroscience within the courtroom. The principle of freedom of evidence is based on article 288 of the Code of Criminal Procedure, according to which offences may be established by any means of evidence, without any ambiguity, thus combining research and assessment. First of all, it is possible to accept that evidence may be established by any means, with no method of proof being excluded in principle. However, the use of neuroscience techniques restricts the principle of freedom of proof and clashes with the legal concept of the autonomy of the will. On the contrary, today's science provides society with more effective means of intruding into the private lives of individuals and violating their so-called sphere of intimacy. The investigation, which appears to be a duel between the investigator and the suspect, is in fact a battle between society and the individual<sup>48</sup>. Evidence is therefore a privileged field that favors the interference of an act of decision with the assertion of knowledge. It gives great latitude to litigants, but also to the judge who, as the recipient of this evidence, remains free to assess its probative value according to his own personal conviction. On the other hand, neuroscience could lead lawyers to believe that neuroimaging is a universal indicator that should replace other elements of proof and that it is capable of accessing the brain in order to justify the principal cause of an act. However, criminal law requires an in-depth understanding of the phenomena that can affect human freedom. "Unlike civil law, individuality takes on a particular meaning, since the criminal judge must judge an individual above all, and not a fact or an act"<sup>49</sup>. It would be perfectly illusory to favor the use of cognitive science procedures to acquire reliable knowledge, as this would be an infringement of the freedom of evidence.

Between impotent evidence and powerful law, if neurology can be conceived at the heart of the criminal trial for the manifestation of the truth sought, there are, among other things, different contributions that could help to elucidate different objects that would allow the judge to make effective use of all the data, thus preserving the freedom of evidence and preserving, moreover, respect for the fundamental rights of the human person.

### **B- A technical and scientific break**

The use of neuroscience in the judicial process requires reliable scientific data. Neuroscience is no longer immune to apparent danger, given the complexity of the brain (b), which hinders the reliability of the data required (a).

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<sup>48</sup> BOUZAT P, "les procédés modernes d'investigation et la protection des droits de la défense",. 5ème congrès international de droit comparé. Brussels,4-9 August 1958. Rapports français de droit pénal. supp. RSC,n°2, April-June 1958. P. 3.

<sup>49</sup> Garraud R, "Traité théorique et pratique du droit pénal français", T. I, Sirey, 1913, 3rd edn, 813, p.n°3, p.8.

### **a- Reliability not yet achieved?**

The promise of neuroscience in the search for the truth is still remote. This is confirmed by the DNA process. Only 10% of DNA contains chromosomes; the rest does not provide any data on health or chromosomal abnormalities. DNA evidence in criminal cases is only relative. "The analysis of nuclear DNA does not provide any so-called sensitive data on the individual; nothing about the ethnicity, size, appearance, character or health of the carrier of the genotype can be revealed [... ] By comparison, the laboratory can tell whether a DNA fragment obtained from a crime scene sample is similar to that of an individual or not. It can in no way determine the height or eye color of that person, let alone guess whether they or their descendants are more likely to rape or develop multiple sclerosis than others"<sup>50</sup>. An illustration can be made when a hair is found at the scene of a crime, and the individual whose hair it belongs to can be identified through a DNA test. However, scientists cannot explain whether this hair was there before or at the time of the crime? Whether someone left it to accuse its owner? These are some of many questions to which science is not able to provide an absolute answer. It is not possible to limit an individual's responsibility with a neuronal or biological analysis, since the factors involved in research appear to be hyper-sensitive to environmental changes and interact in an inescapable way. By analyzing the plasticity of the brain and its ability to shape itself according to experience and learning over the course of a lifetime, scientists are showing that.<sup>51</sup>

Thus Ivrin Rock teaches "Those who undertake the study of perception soon learn that what we perceive is independent of what we know about the objects and events in the visual scene. Illusions do not disappear or fade because we know they are illusions. Conversely, a true perception is not based on what we know about the world. An airplane high in the sky appears small despite our knowledge of its great size, while an unfamiliar, distant object on the ground will be perceived as the correct size despite our little knowledge of its identity"<sup>52</sup>.

That scientific certainty is no longer assured, despite its contribution to the service of justice and its help in resolving theoretical and practical questions. Do neuroscientists believe that they can carry out studies to advise the law and offer it certain explanations for determining the elements of proof? A reflection revolving around the question undoubtedly admits that artificial consciousness is conducive to other elements of the answer, since

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<sup>50</sup> Huyghe F-B, "ADN et enquête criminelle", PUF collection "que sais-je?", 2008, p.13 et seq.

<sup>51</sup> Vidal C, "Le cerveau évolue-il au cours de la vie?", Le Pommier 2009

<sup>52</sup> "perception", Rock I, De Boeck Université, 2001, p.240.

neuroscientific analysis is only one element of assessment among several others.

Jean François LAMBERT<sup>53</sup> admits that "A person is not the image of his brain, and the brain is not, strictly speaking, the subject of our actions or the author of our projects. The German philosopher *Erwin Straus*<sup>54</sup> reminded us as far back as the 1930s. It is the human being who thinks, not the brain". Responsibility lies not only in the brain but in the interaction between people. Social behavior cannot be reduced to a brain configuration, and the same configuration does not necessarily imply the same behavior. The relationship between anti-social behavior and brain abnormalities is not reciprocal. Not every person with an abnormality is a delinquent and not every delinquent is a person with an abnormality. The majority of crimes are committed by people with brains that show no obvious abnormality". The very notion of scientific truth is relative, valid only for a given moment, of which it could be no more than a fiction for the subsequent one.

Anne Laude and Tiphaine Lagarde consider in the same vein that the various techniques used bear witness to the uncertainties and prudence of the courts in assessing their reliability in the light of the current state of scientific knowledge: it is not enough for a method to be scientifically valid for it to be accepted (or legitimized) as legal evidence. In fact, although brain imaging has already been used in American courts of law, it would seem premature to attribute objectivity to these technics<sup>55</sup>.

## **b - Brain complexity as an obsession with scientific truth**

It is no longer a simple matter of opening the skull and recording the major mental functions. It is no longer a matter of modeling brain activity in order to extract the mechanisms responsible for establishing the links between neuronal activity and the cognitive task. While retaining a hazy outline, neuroscience and brain imaging have tried, and are still trying, to invest in cognitive science in order to understand the complexity of how neuronal connections work. From other side, the famous Russian physiologist was considering the brain as a great reflex arc, Donald Hebb, and stated that the operations performed by the brain could explain behavior and that the physiology and biology of an organism could not be separated. The experiments of Lashley and Weiss claimed that the different areas of the brain are undifferentiated and interchangeable, while Sperry based his work on the theory of nervous

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<sup>53</sup> Honorary Senior Lecturer - Université Paris Lumières (Paris VIII), Laboratoire de

<sup>54</sup> *Le sens des sens*, E. Straus, 1989, translated from the German by G. Thines and J-P Legrand. Grenoble: Jérôme Million, pp. 271-472.

<sup>55</sup> Laude A et Lagarde T, "Utilisation des neurosciences par le juge, l'avocat et l'expert : perspective historique", in "le cerveau et la loi : analyse de l'émergence du neurodroit (under the coordination of O. Ollier). p.24.

development. The history of neuroscience has obviously not stopped there, but we must bear in mind that all these findings and all these research processes are aimed at helping us to understand how our brain works. We accept that it is a complex system made up of various systems that differentiate and interact to produce new properties that are greater than the sum of all the component parts. In this respect, Bernard Andrieu<sup>56</sup> clearly explains that "The flesh of the brain considers that the brain is not an objective organ that would be separated from the life of the body, i.e. from its constitution, its metabolism and its adaptation to the environment. As a living organism, the brain is constantly changing, both in its organization and in its specialization. Rather than a simple receptor, the brain is subject to its capacity for plasticity and re-adaptation: this mobility of neuronal networks energizes the brain in terms of both the quality of its mental states and the communication of neurotransmitters. Determined by genetic factors during its development and in its regulation, the brain is not free: the brain must find a neuro-functional<sup>57</sup> 'homeostasis' by synthesizing the contradiction between the part played by genes and the part played by history. We propose to refer to this synthesis as the "flesh of the brain".

Various scientific studies have shown that the brain is an organ of the body that changes as the environment changes. To touch the brain is to touch the hidden identity of the human being. What governs, sits in the brain<sup>58</sup>, and so it is with the governance of our actions, which gives each of us a specificity that brain imaging cannot establish a standard diagnosis for individuals who present the same scientific data. These are predisposing factors, not determining factors. Even if neuroscience has become a cutting-edge discipline, even if brain imaging has made significant progress, even if several neuroimaging techniques have been used for probative purposes, in this sense we remain strangers to ourselves. Scientific studies establish a link between the existence of a cerebral anatomical anomaly and deviant behavior. And yet we are vaguely familiar with words and experiences whose applicability cannot be generalized. We understand nothing of all these phenomena, since the word brain likewise frightens us and brings out metamorphoses from which human's neuronal could no longer be understood.

Andrieu explains: "Covered in philosophy, some apprentices would like to explain the human nature by genetic sequences or neurotransmitter flows alone. But the complexity of

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<sup>56</sup> "La neurophilosophie", Que sais-je, PUF editions (Press Universitaire de France)

<sup>57</sup> Defined by Claude B, homeostasis is the ability of any system (open or closed) to maintain its operating equilibrium despite external constraints.

<sup>58</sup> Changeux J-P, L'homme neuronal, Paris: Fayard, coll "pluriel", 1983, p.15.

Human beings will always outstrip this behaviorism"<sup>59</sup>. It is no longer conceivable that a scientifically valid method could legitimize a judicial decision. Whatever, recourse to neuronal processes is no longer trivial; they must be integrated, while the decision handed down must be based on a balance of the various elements involved.

“Published scientific studies” are carried out under a highly controlled conditions where the subjects are, by definition, volunteers and willing to take part in the study. Often, the results are weak and the conclusions are based on the averaged fusion of several images from several subjects, without any significant result being obtained in any particular subject. Even when the results are obtained individually on each subject, these are laboratory conditions that are very different from those in the real world".<sup>60</sup>

## ***Conclusion***

Although neuroscience aims to convince judges in the courtroom, it does not sit well with jurisdictional expertise. The context in which they are used does not make its mark, given the decision-making process imposed on the judge. It is therefore clear that the dialectic of neuro-justices, understood in this sense, corresponds to a new discipline that still deserves to be more experimented. Functional brain imaging studies often seem difficult to figure, carry out and interpret. Their application goes well beyond the therapeutic field and has implications for society as a whole. Can we find other traces of these ideas? In everything to do with neurolaw, in all the expectations that rest on the interference of neuro-justice with the criminal trial, in all the jostling of the sciences over the traditional course of the proceedings, these protective conceptions tend to designate in an autonomous way the individual to be primarily suspected. The law of cognition could be seen, through numerous principles of procedural law, as a conditional reasoning for the future of law. The brain retains its mystery, it remains unknown and does not reveal its precious secrets; it is unreachable. Cerebral imaging, on the other hand, is capable of making a count, but it remains, whatever, deficient, despite the fact that it has

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<sup>59</sup> La neurophilosophie", Que sais-je, editions PUF ( Press Universitaire de France)

<sup>60</sup> Lebihan D, "le cerveau de cristal. Ce qui nous révèle la neurologie", Paris Odile Jacob, p. 102.

opened the door to the brain's physiology. This means that it is no longer easy to understand behavioral compartments. The neural workspace is evolving, however, and forensic writing could not react without it due to the emergence of artificial intelligence. Daniele Bourcier<sup>61</sup> explains that an algorithm implemented on a neural network modeling a dispute highlights the criteria that govern the judge's decision. This system has been tested in the delicate field of the repression of aesthetic prejudice". These machine-brains reveal the complexity of their systems, and the legislator could impose certain rules to limit their use.

In short, a good understanding of human behavior is reflected in the implementation of a judicially correct rational procedure, legitimized by a cognitive certainty that acquires a persuasive authority and reinforces the reliability of the procedural tools competent to legitimize the content of a decision.

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