PREDICTABILITY AND REASONABLENESS OF DOUBT IN THE AGE OF AI-LAW AND NEUROLAW

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Abstract: *Translating legal neuroscience with artificial intelligence: only in this way will there be a low percentage of wrongful convictions. For some time now, especially in common law jurisdictions, nanotechnology has not been such a remote idea for intervening in the brain activity of criminals. It is a valid reversible tool selective, precise and effective than psychopharmacological treatments. The technology, on which the neurodevices are based, provides a pulse that alerts the subject with such implanted tools,without inhibiting him from his free will and conscious control. The function is thus twofold: predictive and preventive-rehabilitative. The debated question is whether neurointervention should be only voluntary or also mandatory. Is neurointervention an essential component of sentencing or only one of its possible forms? An attempt will be made here to provide an opinion on how the use of nanotechnology applied to neurolaw is legitimate to the principles of substantive and procedural criminal law.*

Keywords: *neurolaw, biolaw, AI, predictive justice, criminal and procedural law, ethics*

1. INTRODUCTION

The newly configured institutes of conscious guilt and intentionality are linked to the ontological categories of criminal conduct in all its nuances, from free will to the general theory of crime and criminal responsibility.[1] The idea of a human being endowed with freedom, intentionality and responsibility is an illusion, as there is not really such a thing as a mind capable of free deliberation regardless of what happens within it.[2] In fact, brain processes are involved in certain mental activities and causal relations at the macroscopic level reducible to causal relations at the microscopic level.[3] So it can be inferred a strong iological component underlying criminal violence: from genes linked to an increased

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[1] Free will as we normally understand it is an illusion generated by our cognitive architecture. The idea that responsibility can also be attributed to a nonpsychic will is not unknown to criminal law itself. While the main features of mental phenomena (consciousness, intentionality, subjectivity and mental causation) are at first glance irreconcilable with a scientific worldview, it is equally true that this (apparent) inconsistency is due to a basic misunderstanding of the nature of mental phenomena. In fact, mental phenomena as an integral part of nature and, on the other hand, uses a model of explanation that is applicable both to the mind-brain relationship and to many other natural phenomena .This is a radical revision of the idea of intentionality, which is no longer understood as something immaterial, but as strongly a biological state. Now, the problem is that mind as a material phenomenon is a new concept for criminal law, which is based on the implicit assumption of mind-body (or mind-brain). GAZZANIGA, M. S. *Who's in Charge? Free Will and the Science of the Brain.* New York: Harper Collins Publishers, 2011; LAVAZZA, A., SARTORI, G. *Neuroetica. Scienze del cervello, filosofia e libero arbitrio.* Bologna: Società editrice il Mulino, 2011.

[2] LIBET, B., GLEASON, C. A., WRIGHT, E. W., PEARL, D. K. Time of Conscious Intention to Act in Relation to Onset of Cerebral Activity (Readiness-Potential). The Unconscious Initiation of a Freely Voluntary Act. in Brain. *A Journal of Neurology.*1983, Vol. 106, No. 3, p. 627.

[3] ARAGONA, M. The concept of mental disorder and the DSM-V. *Dialogues in Philosophy, Mental and Neuro Sciences.* 2009, Vol. 2, No. 1, p. 12; AMORETTI, M. C., LALUMERA, E. A potential tension in DSM-5: The General Definition of Mental Disorder versus Some Specific Diagnostic Criteria. *Journal Of Medicine And Philosophy.* 2019, Vol. 44, No. 1, p. 103.

likelihood of developing deviant behavior, to the role of neurotransmitters and brain development in regulating violent impulses.[4] Notions of retributivism of criminal responsibility depend on this illusion that criminal justice must necessarily take into account. Biological and other psychological and sociological variables also play a causal role, and mental states turn out to be fundamental to a full causal explanation and understanding of human action.[5] In fact, an individual who commits a crime, manifesting a mens rea, is worthy of criminal sanction: this is because there is the idea of the human being as an "agent who forms intentions, produced by desires and beliefs elaborated at the mental level, and who acts on the basis of those."[6]

2. JUSTICE AND THE NEURO-TECHNIQUE OF LAW

Criminal rules, substantive and procedural, should provide precise criteria to enable the judge to assess the risk of criminally relevant behavior. Moreover, with particular regard to pre-trial detention (or similar coercive measures), it should be remembered that they are usually applied at the initial stage of the criminal proceedings, when the competent authorities have little information, either about the facts that have occurred or about the personality of the suspect, since the file is still incomplete.[7] The involvement of constitutional-rights in the development of the criminal trial case imposes the reservation of law and the reservation of jurisdiction.[8] The criminal trial performs a cathartic function for the accused and is to be regarded as an anticipated punishment or re-education that has already begun.[9] Unfair if unfounded indictment leads to conviction. Hence the legitimate need for the judge's reasoning to explain in the decision the parameters used in evaluating the evidentiary material. The combined use of legal neuroscience and AI is necessary to identify the evaluative parameters based on the laws of logic and scientific data, capable of reasonably clarifying the guilt or innocence of the accused. The 'ascertainment of facts through the tools derived from technological and neuroscientific evolution is established by a norm in the Italian legal system open for the regulation of evidence not regulated by law (art. 189 c.p.p.).[10] This is the so-called innominate evidence (which allows obtaining an element different from that prosecutable

[4] HUMBACH, J. A. Do Criminal Minds Cause Crime: Neuroscience and the Physicalism Dilemma. *Washington University Jurisprudence Review.* 2019, Vol. 12, No. 1, p. 23.

[5] GARLAND, B. *Neuroscience and the Law. Brain, Mind and the Scales of Justice.* New York-Washington D. C.: Dana Press, 2004, p. 64.

[6] JONES, O. D., MONTAGUE, R., YAFFE, G. Detecting Mens Rea in the Brain. *University of Pennsylvania Law Review.* 2020, Vol. 169, No. 1, p. 97.

[7] DAMAŠKA, M. R. *The faces of justice and state authority: a comparative approach to the legal process.* New Haven-London: Yale University Press, 1986, p. 119.

[8] PAONESSA, C. *Gli obblighi di tutela penale. La discrezionalità legislativa nella cornice dei vincoli costituzionali e comunitari.* Pisa: ETS, 2009, p. 98.

[9] STELLA, F. *Giustizia e modernità. La protezione dell'innocente e la tutela penale delle vittime.* Milano: Giuffrè, 2003, p. 37.

[10] To be distinguished from irritual evidence (that which, not falling within the legal catalog, aims to obtain typical evidence) and anomalous evidence (that in which a typical means of evidence is used to acquire elements that can be acquired by another typical means of evidence). The latter two cases remain excluded from the scope of Article 189 of the Code of Criminal Procedure.

by typical means of evidence).[11] The operativeness of the rule (with possible impact also on the methods of acquisition) is therefore limited only to evidence that cannot be traced to any legal model.[12] One area open to the problematic nature of atypical evidence, however, would seem to be that constituted by the so-called (new) scientific evidence. Atypical evidence arises from 'non-compliance with the prescribed regulations for its taking, thus illegitimate evidence and consequently unusable, invalid or irregular.[13] The issue, especially in the Italian system, seems to find no convincing solutions, as there are orientations tending to favor recourse to Article 189 of the Code of Criminal Procedure, resulting in an adversarial debate on the method; for another, there is a move toward Article 190 of the Code of Criminal Procedure, considered adequate to assess the admissibility of the evidence, without trespassing into an advance assessment.[14] From the point of view of guarantees, the legislature refers to the admission of atypical evidence to the judge's assessment, after verifying its suitability for the ascertainment of facts and its compatibility with the protection of the person's moral freedom under Article 188 of the Code of Criminal Procedure.[15] In other words, although atypical, the legislature regulates through a formal procedure the manner through which its admission is permitted.[16] But how can competent judicial authorities reliably and convincingly justify the risk of the suspect's future behavior and avoid unjust charges and convictions? Having overcome the opposing orientations that considered the use of a probabilistic scientific law sufficient, even if with low probability, and those that required one with high probability, close to certainty, there has been a move, also on the basis of American jurisprudence, toward a logical probability supported by a high degree of rational credibility.[17] The datum should emerge from cross-examination among experts, so that the judge can make a judgment about the validity of the evidence and the scientific method adopted.[18] The area in which judges have most traditionally been called upon to evaluate the defendant's future behavior is that of sentencing.[19] Yet there isn't clear distinction between affirmation of guilt and quantification of punishment: the former, unmotivated, referring to establishing the facts and meeting the burden of proof; the latter, reasoned, aimed at quantifying the penalty.[20] The reliability of a scientific method must be tested according to Daubert

[11] It is not innominate evidence and therefore admissible under Article 189 of the Code of Criminal Procedure.
[12] COLLICA, M. T. *Il reo imputabile, in De Vero (a cura di), La legge penale, il reato, il reo, la persona offesa, Trattato teorico/pratico di diritto penale, diretto da PALAZZO – PALIERO*. Torino: Giappichelli, 2010, p. 459.
[13] CARNEVALE, A., MENNA, R., COLAGRECO, A. La perizia criminologica nel processo penale: dal codice del '30 ai giorni nostri. *Rivista Italiana di Medicina Legale*. 1995, p. 371.
[14] PAONESSA, C *Gli obblighi di tutela penale. La discrezionalità legislativa nella cornice dei vincoli costituzionali e comunitari. p.* 101.
[15] Ibid., p. 115.
[16] Ibid., p. 173.
[17] HACKING, J. *L'emergenza della probabilità. Ricerca filosofica sulle origini delle idee di probabilità, induzione e inferenza statistica, trad. it.* Milano: Il Saggiatore, 1987. TALEB, N. N. *The Black Swan. The Impact of the Highly Improbable*. New York: Random House, 2007, p. 54.
[18] FODOR, J. A. Special Sciences (Or: The Disunity of Science as a Working Hypothesis). *Synthese*. 1974, Vol. 28, No. 2, p. 97; TONINI, P. La prova scientifica, considerazioni introduttive. *Dir. pen. Proc*. 2008, No. 6.
[19] FORNARI, U. *Al di là di ogni ragionevole dubbio, ovvero, sulla cosiddetta prova scientifica nelle discipline psico-forensi*. Torino: Espress Edizioni, 2012, p. 43.
[20] CAPRIOLI, F. L'accertamento della responsabilità penale "oltre ogni ragionevole dubbio" *Riv .it. dir. proc. pen.* 2009, Vol. 52, No. 1, p. 51.

standards.[21] The theories that inspire digital risk assessments conform to the 'Daubert test,' having become a cornerstone of national evidentiary law.[22] This appears essential with regard to both traditional predictive models of social dangerousness and the more recent tools implemented for pre-trial decisions.[23] Here too, despite the much anticipated moment of predictive assessment, the frame of reference remains that of evidentiary law. These perspectives result in the coincidence of criminal law with empirical facts, a coincidence that "must be pursued at all costs, transferring scientific findings into criminal law."[24]

3. HUMAN RIGHTS AND NANOTECHNOLOGY SCIENCE: A NEURO-LEGAL PROBLEM

Can the discussion of risk assessment tools be considered inappropriate because it tends to divert attention from what constitutes the most plausible approaches and responses to the problem of crime? Where do we draw the line between person-to-person variation and a serious anomaly that caused the commission of a crime? The answer lies in the justification of believing that a criminal law must know how the human brain works, through merging the prescriptive dimension of law (what it should be) and the descriptive dimension of neuroscience (what it is), choosing to by virtue of "scientific and legal acceptance."[25] While it is arguable that incarceration is an appropriate tool to achieve this goal, any kind of intervention that re-proposes the same form of relationship enacted in crime is *a fortiori* unsuitable.[26] Rehabilitation is not something done to the offender but by the offender. On the contrary, having a high level of consciousness means being

[21] In Daubert v. Merrell Dow (1993)-by which the rules and condition for the validation of the statements made by the expert witness (expert witness) were established: the validity of the methodology; its submission to peer published review; the possible known or potential rate of error; acceptance by the scientific community; in other words, the applicability of the principle of falsification and the presence of a low rate of error. Daubert v. Merrel Dow Pharmaceuticals Inc,which presides over the admission of scientific and technical expertise. That decision, whose importance and authority has crossed federal borders to influence the Supreme Courts of a great many states, including those in continental Europe, in fact established a decalogue for the entry of declaratory evidence based on scientific theories into the criminal trial. Five elements were indicated by the Court-and then taken up and reworked in subsequent pronouncements-to determine whether the scientific theory proposed by the expert is sufficiently validated to be placed as the basis of an evidentiary evaluation: (a) whether the expert's technique or theory has been (or can be) tested (i. e., whether the expert's theory can be validated in objective terms, or whether it is merely a subjective, apodictic approach that cannot be reasonably assessed for reliability); (b) whether or not the technique or theory has been reviewed and published by the relevant scientific community; (c) whether or not the rate of error (even potential error) in the application of the technique or theory is known; (d) the existence and maintenance of standards for testing the theory; and (e) whether or not the technique or theory has been generally accepted by the scientific community.

[22] TARUFFO, M. Le prove scientifiche nella recente esperienza statunitense. *Riv. trim. dir. proc. civ.* 1996, Vol. 8, p. 236.

[23] DAMIANO, L., DUMOUCHEL, P. *Vivere con i robot. Saggio sull'empatia artificiale*. Milano: Raffaello Cortina Editore, 2019, p. 15.

[24] RYBERG, J. Compulsory Medication, Trial Competence, and Penal Theory. *Law, Ethics and Philosophy*. 2016, No. 4, p. 63.

[25] IENCA, M., ANDORNO, R. Towards new human rights in the age of neuroscience and neurotechnology. *Life Sciences, Society and Policy*. 2017, Vol. 13, No. 5.

[26] MAHLMANN, M. *Mind and Rights: Neuroscience, Philosophy, and the Foundations of Legal Justice, in Sellers, Law, Reason, and Emotions*. Cambridge: Cambridge University Press, 2017, p. 129.

„conscious of being conscious."[27] A specific predictive tool, for pre-trial and bail decisions, is emerging in the United States: jurisdictions (and among them three states) are using the Public Safety Assessment (PSA) to assist the judge in deciding on the risk of releasing the arrested defendant back into custody before the trial is finalized.[28] The software would be useful in reducing the number of people detained before trial.Here is an example of a risk assessment tool, i.e., the main tool for assessing (not 'believing' potential recidivism). Psycho-criminological risk assessment has become crucial in several areas of criminal decision-making, at the pre-trial stage, in sentencing, in relation to prison benefits, and in the follow-up of psychiatric situations.[29] Based on the classical assumption that

[27] SOMMAGGIO, P., MAZZOCCA, M., GEROLA, A., FERRO, F. Cognitive liberty. A first step towards a human neuro-rights declaration. *BioLaw Journal*. 2017, No. 3, p. 41.

[28] Founded on only 9 factors, the instrument is actuarial, taking into consideration: the individual's age, pending charge, and criminal history. Race, ethnicity and local factors (such as place of birth or residence) are not taken into account because, according to the authors, they would not know to a higher accuracy of prediction. The PSA also does not require an interview with the accused: information can be extracted from the criminal records and pending charges certificate, as well as other general information known to public authorities. Based on algorithms created for the purpose, the tool produces a scale for assessing the individual's risk under three different parameters (FTA: Failure To Appear; NCA: New Criminal Activity; NVCA: New Violent Criminal Activity), which can be used by the judge along with the so-called Decision-Framework, to decide whether the arrestee will be released or detained. Regardless of any consideration of the 'apparent violation of the presumption of not guilty inherent in the NCA indices,the particularity of this tool, compared to those considered so far, is its alleged ability to provide a „Failure To Appear" index. The risk factors considered by the PSA for this parameter are: - pending charges at the time of the offense (S/N); - previous convictions (S/N); - previous failure to appear in court in the past 2 years (No/One/2 or more times); - previous failure to appear, prior to the last 2 years (S/N The reasons for the success of the PSA in the North American context are to be found in the profound crisis surrounding the institution of bail, i.e., pecuniary bail, which has been shown to be highly discriminatory against weaker social groups (and, therefore, potentially conflicting with the Eighth Amendment to the federal Constitution, which prohibits an 'excessive bail,' though without defining it). This situation, to which an infrequent bi-partisan convergence for the abandonment of bail underlies, has propitiated the emergence of pre-trial risk assessment tools aimed at increasing the margin of releases and access to forms of trial diversion. However, there are few studies focusing on the actual impact of the use of pretrial risk assessments. First, referring to the most popular pretrial risk assessment tool in the United States at the moment, the PSA precisely, it is worth noting that its main difference from other actuarial tools is the FTA index. However, the factors considered in assessing an individual's propensity to flee are not supported in the literature by any empirical evidence of actual relevance in terms of the risk of the accused's failure to appear at the hearing. While the risk factors of criminal behavior, along with protective factors, criminogenetic needs, and correlates, have been the subject of extensive and in-depth empirical scientific research, for about a century, there seems to be a complete absence of a finding—in the scientific literature—that demonstrates in convincing terms the relevance of FTA factors. There is apparently a lack of evidence that the incorporation of these factors into an actuarial tool is capable of outperforming, in terms of reliability, the judge's individual assessment. For that matter, such feedback is particularly difficult to obtain. Comparing the results of the PSA with the judicial decisions made by individual judges is vitiated by the fact that the failure to obtain a bail may depend either on the judge's more or less correct assessment of a high risk of absconding or, more trivially, on the overestimation of the economic capacity of the arrestee, on whom a condition has been imposed that he or she is unable to fulfill. In addition, the judge's individual assessment may be influenced by factors other than risk, such as proportionality to the pending charge, which, in the face of a risk of flight or criminal behavior that is not insignificant, may not justify remand detention of the accused. It is very difficult, therefore, to establish parameters to measure the goodness of human choices in pre-trial risk estimation. In doubt whether pretrial risk assessment tools really outperform humans in predicting endo-procedural risks. Moreover, because tools such as the PSA rely solely on information from files and records, without bi dream of an interview with the defendant, some authors have criticized its structure. Indeed, it would seem contradictory to claim the overcoming of the pecuniary bail system by suggesting tools that are completely based on data extracted from the very system targeted by the reform itself).

[29] QUATTROCOLO, S. *Artificial Intelligence, Computational Modeling and Criminal Proceedings. A Framework for A European Legal Discussion*. Berlin: Springer, 2020, p. 123.

"nothing predicts behavior as well as (or better than) previous behavior," "such instruments include a number of risk factors, which may or may not be balanced, to provide a risk rating (high, medium, low) of dangerousness, or a probability score (i.e., a percentage probability of recidivism within a certain time period), or both."[30] Falsifiability is the central issue of the whole issue on predictive sentencing. The purpose of 'risk assessment' should be to guide subject-specific intervention and implement prevention of future antisocial behavior by pointing the subject to desirable alternatives to crime and the more reliable the risk assessment, the more achievable this goal is.[31]

4. EVOLUTIONARY PERSPECTIVES OF THE GENERAL THEORY OF CRIMINAL NEURO-LAW

Scientific results show that brain maturation is not complete until about 20-22 years of age.[32] The relationship between incomplete brain development and susceptibility to crime stems from the fact that the prefrontal cortex, (the brain area located behind the forehead and linked to self-control and the ability to make rational decisions), is the last brain area to fully mature (around 20-22 years of age).[33] In contrast to the adult brain, altered interaction between the activity of the amygdala, ventral striatum, and prefrontal cortex constitute the neural correlates of the tendency toward impulsivity, as well as intense susceptibility to the immediate reward system and social evaluation.[34] These brain changes, while increasing the incidence of socially sanctioned behavior, are actually functional to the survival and separation of adolescents from their parents, and occur during the adaptive transition from a state of dependence to one of independence.[35] This constitutes a necessary condition for mental capacity, which cannot be assumed unless the brain has completed its natural development. This is the crux of the relationship between mental states and/or manifest psychological functions that the law has always regarded as necessary prerequisites for a subject's criminal responsibility and their neural correlates (a neutral term that still assumes neither causation nor determination).[36] Brain immaturity is a concept that combines a description of the state of the average young man's brain with an assessment of the fact that he has not yet reached the final stage of development found in adults, implying a negative judgment of this stage in relation to some, though not all, of the behaviors of young people. If the environmental context is characterized by high affectivity, young adults enact much more adolescent-like

[30] QUATTROCOLO, S. Quesiti nuovi e soluzioni antiche? Consolidati paradigmi normativi vs. rischi paure della giustizia digitale predittiva. *Cass. pen.* 2019, Vol. 59, No. 4, p. 1755.
[31] SYRJÄLÄ, E. *Prospective Study Evaluating a Pain Assessment Tool in a Postoperative Environment: Protocol for Algorithm Testing and Enhancement. JMIR Res Protoc.* 2020, p. 77.
[32] SOMERVILLE, L. H. The Teenage Brain: Sensitivity to Social Evaluation, Current Directions. *Psychological Science.* 2013, Vol. 22, No. 2, p. 125.
[33] GIEDD, J. L., BLUMENTHAL, J., RAPOPORT, J. L. Brain Development During Childhood and Adolescence: A Longitudinal MRI Study. *Nature Neuroscience.* 1999, Vol. 2, p. 861.
[34] LICKLEY, R. A. The neural basis of reactive aggression and its development in adolescence. *Psychology, Crime & Law.* 2018, Vol. 24, No. 3, p. 319.
[35] FUSELLI, S. *Neurodiritto. Prospettive epistemologiche, antropologiche e biogiuridiche.* Milano-Udine: Mimesis Edizioni, 2016, p. 141.
[36] VILARES, I., WESLEY, M. J., BONNIE, R. J., HOFFMANN, M. Predicting the Knowledge– Recklessness Distinction in the Human Brain. *Proceedings of the National Academy of Sciences.* 2017, Vol. 114, No. 12, p. 3222.

behaviors, as opposed to neutral contexts in which the young adult tends to engage in adult-like behaviors.[37] So it makes no sense to refer to the criterion of "reaching the age of majority" in order to be able to speak of full responsibility, and a specific law for those above a certain age threshold should also be considered. Indeed, if a brain state determines the diminished ability of adolescents and young adults to control impulses and make rational choices, that is, if this inability results from the brain's inadequacy to support the mental states presupposed by responsibility, the relationship between brain states and related mental states depends solely on developmental-related immaturity, thus on a merely bio-chemical factor.[38] Thanks to recent neuroimaging techniques, within the brains of young people,in particular, during adolescence, the brain is actually still in a developmental stage.[39] Deep structural changes occur within the brain that appear to greatly influence (along with other factors) observable behavior , making adolescents more likely than the adult population to engage in deviant behavior. Adolescents exhibit three characteristics: deficiencies in decision making, increased vulnerability to coercive circumstances, and unformed character due to developmental immaturity.[40] Brain immaturity thus constitutes one of the triggers for delinquency. So becoming an adult in the legal sense does not coincide with becoming an adult in the biological sense.[41] The idea of young adult age, and consequently full responsibility, established by the criminal code conflicts with empirical evidence that, on the contrary, underscores its unfoundedness.[42] In fact, the idea of cerebral immaturity is linked to that of neuroplasticity, a principle that also supports the effectiveness of rehabilitation and reeducation programs for crime prevention, long-term reduction of relapse rates, and thus the orientation of juvenile behavior toward socially desired goals.[43] In this way, more emphasis is placed on pedagogical rather than punitive goals. It would be possible to intervene in time on the not yet fully developed brains of adolescents who, for example, live in unfavorable socioeconomic and environmental contexts in order to prevent the repetition of socially inappropriate behavior or the formation of a brain habitus that would then permanently condition the subject. The interaction between genetic and environmental factors and the influence of environmental factors on brain development are elements that complicate a view of pure brain determinism.[44] In fact, it may be the

[37] McMILLAN, J. *Containing Violence and Controlling Desire.* In: David Birks - Thomas Douglas (eds.). *Treatment for Crime. Philosophical Essays on Neurointerventions in Criminal Justice.* Oxford: Oxford University Press, 2018, p. 225.

[38] STEINBERG, L. Less Guilty by Reason of Adolescence: Developmental Immaturity, Diminished Responsibility, and the Juvenile Death Penalty. *American Psychologist.* 2003, Vol. 58, No. 12, p. 1009.

[39] EDELMAN, G. M. *Neural Darwinism: The theory of neuronal group selection.* New York: Basic Books, 1987, p. 83; CRAVER, C. F. *Explaining the Brain: Mechanisms and the Mosaic Unity of Neuroscience.* Oxford: Oxford University Press, 2007, p. 95.

[40] MILLS, K. L., GODDINGS, A. L., CLASEN, L. S., GIEDD, J. N., BLAKEMORE, S. J. The Developmental Mismatch in Structural Brain Maturation During Adolescence. *Developmental Neuroscience.* 2014, Vol. 36, No. 3–4, p. 147.

[41] CASEY, B. J., TOTTENHAM, N., LISTON, C., DURSTON, S. Imaging the Developing Brain: What Have We Learned About Cognitive Development? *Trends in Cognitive Sciences.* 2005, No. 9, pp. 104–110.

[42] GAZZANIGA. The Law and Neuroscience. *Neuron.* 2008, Vol. 60, No. 3, p. 415; SAMMICHELI, L. Neuroscienze e diritto: tra buona scienza e asimmetrie concettuali. *Giornale Italiano di Psicologia forense.* 2016, No. 4, p. 790.

[43] HICKOK, G. *The Myth of Mirror Neurons: The Real Neuroscience of Communication and Cognition.* New York-London: Audible Inc., 2014, p. 55.

[44] SELLARS, W. Empiricism and the Philosophy of Mind, in Feigl-Scriven. *Minnesota Studies in the Philosophy of Science.* 1956, Vol. I; FEIGL, H., SCRIVEN, M. (eds.). *The Foundations of Science and the Concepts of Psychology and Psychoanalysis.* Minnesota: Minnesota Center for Philosophy of Science, 1956, p. 257.

case that the brain composition that the subject happens to have at the completion of his physical development (at age 25) determines at least in part his behavior.[45] Hence the idea that adolescents and young adults are not fully responsible for their misconduct because the high permeability of their brains would reduce their counterfactual reasoning, as well as their ability to inhibit impulses.[46] Although a mature brain does not necessarily always cause deviant behavior, brain maturity seems to be an indispensable biological basis for talking about full responsibility.[47] Not everyone who commits a crime shows an altered brain profile, nor is it true that everyone with an altered brain profile is a delinquent.[48] The concept of brain immaturity, in fact, is different from the concept of immaturity implied in criminal law, but also from that implied in psychiatry.[49] It is important for neurolaw the attempt to understand how cerebral immaturity and psychological immaturity interact, as well as which type of immaturity is the most decisive in determining whether or not an individual has a given mental capacity.[50] It turns out to be reasonable to undoubtedly consider an inconsistency between the law and neuroscientific studies on brain development, so that this conflicting relationship could, at least potentially, inform us of the need for reform of the justice system; it is also reasonable to say that a number of young adults cannot be held fully responsible for their actions because their neurobiological immaturity makes them at least partially incompetent.[51]

5. NEUROETHICS

The quarantine model theory of criminal justice proposes that anyone who commits a crime (and even, at least in some cases, those who are simply judged dangerous) should not be put in prison but be quarantined so that they cannot harm society.[52] Is quarantine morally justified? Coercively ordered quarantine without the use of appropriate psychotherapeutic and psychopharmacological treatment can aggravate the already existing pathological situation.[53] The most obvious example is the pandemic due to the spread of Covid 19 and the consequences of forced lockdown and restriction of basic freedoms, which have caused considerable psychological problems for human beings even after the

[45] MORSE, S. J. The Status of NeuroLaw: A Plea for Current Modesty and Future Cautious Optimism. *The Journal of Psychiatry & Law*. 2011,Vol. 39, No. 4, pp. 595–626.
[46] KRAVITZ, E. A. Serotonin and Aggression: Insights Gained from a Lobster Model System and Speculations on the Role of Amine Neurons in a Complex Behavior. *Journal of Comparative Physiology*. 2000, Vol. 186, No. 3, p. 226.
[47] VAN OUDENHOVE, L. The Philosophical Mind-Body Problem and Its Relevance for the Relationship Between Psychiatry and the Neurosciences. *Perspectives in Biology and Medicine.* 2010, Vol. 53, No. 4, p. 547.
[48] AMORETTI, M. C., LALUMERA, E. Il criterio del danno nella definizione di disturbo mentale del DSM. Alcune riflessioni epistemologiche. *Rivista internazionale di Filosofia e Psicologia.* 2018, Vol. 9, No. 2, p. 139.
[49] SOMERVILLE, L. H. Searching for Signatures of Brain Maturity: What Are We Searching For? *Neuron*. 2016, Vol. 92, No. 16, p. 1164.
[50] GAZZANIGA, M. S., MANGUN, G. R., POEPPEL, D. *The Cognitive Neurosciences.* Boston: The MIT Press, 2020, p. 23.
[51] SHEN, F. X., HOFFMAN, M. B., JONES, O. D., GREENE, J. D. Sorting Guilty Minds. *New York University Law Review*. 2011, Vol. 86, No. 5, p. 1343.
[52] D'ALOIA, A., ERRIGO, M. CH. *Neuroscience and Law. Complicated Crossings and New Perspectives.* Cham: Springer, 2020, p. 273.
[53] CONNOR, J., MADHAVAN, S., MOKASHI, M. Health risks and outcomes that disproportionately affect women during the Covid-19 pandemic: A review. *Social Science & Medicine*. 2020, Vol. 266, No. 6; THAVORN, K. Global prevalence of mental health issues among the general population during the coronavirus disease-2019 pandemic: a systematic review and meta-analysis. *Scientific Reports.* 2021, Vol. 11, No. 1, p. 32.

relaxation of emergency measures.[54] Knowledge of mental states predicts that there is an awareness of the harmful consequences that misconduct can cause, even if there is not necessarily an intention to cause them.[55] If x sets fire to a set y consisting of n people, and he knows that his act may accidentally cause the death of those n people even though he does not intend to kill them, we are dealing with a conscious mental state. But if x sets fire to set y without consciously considering the consequences of his act, his mental state is defined as reckless. does not take this kind of case into account. It is typical the distinction between punishment and security measures, the former based on culpability, the latter based on the dangerousness of the individual. In such a scenario, despite the general recognition of the presumption of innocence, provided for in every European jurisdiction, the different purposes of punishment and pre-trial detention tend to blur, creating the expectation of an early and immediate deprivation of liberty, with a general disregard for the outcome of the trial and, therefore, for the actual conviction of the defendant.[56] The combined effect of these two tendencies is a serious threat to the presumption of innocence. In general, the assertion that direct brain intervention can be nonconsensual is linked to the idea that crime is a consequence of deviance, a sign of dysfunction that the state has the right and duty to neutralize and possibly correct or prevent, in the same way that it would act to protect people in the event of an epidemic through mandatory vaccination or quarantine.[57] Thus so that the latter do not spread contagion, it is acceptable to confine them against their will as if to protect the healthy. The same can be done with offenders, making the criminal justice system fairer and more humane. Decisions, on remand and sentencing, involve an assessment of risk, an 'endo-procedural risk,' for example, the dispersal of evidence, which crucially affects the conduct of the proceedings, or a 'social risk,' such as that of recidivism following execution of the sentence.[58] The need to incorporate a risk assessment into judicial decisions on cautionary

[54] CHHIBBER, A., KHARAT, A., KNEALE, D., WELCH, V., BANGPAN, M., CHAIYAKUNAPRUK, N. Assessment of health equity consideration in masking/PPE policies to contain COVID-19 using PROGRESS-plus framework: a systematic review. *BMC Public Health*. 2021, Vol. 21, No. 1, p. 1682; CASEROTTI, M., GAVARUZZI, T., GIRARDI, P. Who is likely to vacillate in their COVID-19 vaccination decision? Free-riding intention and post-positive reluctance. *Preventive Medicine*. 2021, Vol. 154, No. 8, p. 154; ARMSTRONG, R. A., KANE, A. D. Cook Decreasing mortality rates in ICU during the COVID-19 pandemic. *Anesthesia*. 2021, Vol. 76, No. S3; WANG, Q. Q., VOLKOW, M. D. Increased risk of COVID-19 infection and mortality in people with mental disorders: analysis from electronic health records in the United States. *World Psychiatry*. 2021, Vol. 20, No. 1, p. 126.

[55] MCMAHAN, J. Moral Liability to 'Crime-Preventing Neurointervention. *Birks-Douglas*. 2018, Vol. 9, No. 3; BIRKS, D., DOUGLAS, T. *Treatment for Crime. Philosophical Essays on Neurointerventions in Criminal Justice*. Oxford: Oxford University Press, 2018, p. 117.

[56] WHITMAN, J. *The Origins of Reasonable Doubt*. New Haven-London: Yale University Press, 2005, p. 46; DRIPPS, D. A. The Constitutional Status of the Reasonable Doubt Rule. *California Law Review*. 1987, Vol. 75, No. 5. DERSHOWITZ, A. M. *Dubbi ragionevoli. Il sistema della giustizia penale e il caso di O. J. Simpson (1997)*. Milano: Giuffrè, 2007, p. 63; CANZIO, G. L' oltre il ragionevole dubbio come regola probatoria e di giudizio nel processo penale. *Riv. it. dir. proc. pen*. 2004, p. 303; FERRUA, P. *La colpevolezza oltre ogni ragionevole dubbio, in AA.VV., Il nuovo regime delle impugnazioni tra Corte Costituzionale e Sezioni Unite*. Padova: CEDAM, 2007, p. 143.

[57] GLIK, D. C. Risk communication for public health emergencies. *Annual Review of Public Health*. 2007, Vol. 28, No. 1, p. 35; COVELLO, V. T., PETERS, R. G., WOJTECKI, J. G., HYDE, R. C. Risk communication, the West Nile virus epidemic, and bioterrorism: responding to the communication challenges posed by the intentional or unintentional release of a pathogen in an urban setting. *Journal of Urban Health*. 2001, Vol. 78, No. 2, p. 382.

[58] GARAPON, A., LASSEGUE, J. *Justice digitale. Révolution graphique et rupture anthropologique*. Paris: Presses Universitaires de France, 2018, p. 24.

and sentencing is key to understanding how important the prediction of an individual's future behavior can be, in the context of an assessment focused on a past event and avoiding wrongful convictions and imprisonment.[59] Consequently, risk prevention (endo-procedural or 'social'), is traditionally incorporated in both pre-trial and sentencing decisions, highlighting how, in such decision-making moments, the two concepts of repression and crime prevention inevitably blur together. Consider behavior in part through mental states such as desires, beliefs, intentions, wills and plans. Whenever there is a psychological difference there must also be a brain difference. Pains and other mental phenomena are simply characteristics of the brain (and central nervous system). Mental phenomena are thus structural and biological features of brain functioning, as properties of the nervous system that, however, have their own autonomy.[60] There is the idea of recovering the concept of the intentional agent through a "biological naturalism," that is, the naturalist solution to the mind-brain problem.[61] It is not necessary to determine in advance whether we are free or whether we can have some degree of conscious control over our manifest behavior.[62] In this sense, the law, which has already incorporated psychic and brain pathological states as mitigating or exempting factors, would not be "revolutionized" by neuroscience, only made more precise.[63] This is the case, for example, with the application of the Criminal Code articles governing liability. These are, evidently, two decisive factors in the 'predictive' task to which the judge is called. In scientific and technological research, every crucial breakthrough that produces an increase in power also causes a loss of innocence.[64] Criminal action reduces the victim to a passive receiver.[65] At the same time, however, punishment cannot turn a criminal into a passive receiver.[66] If one accepts, following the European Charters, that the criminal's mental integrity also deserves protection, that which acts in the same way the offender acted cannot be part of the punishment itself.[67] The use of direct interventions on the brain through drugs or devices cannot otherwise be justified except for therapy, that is, for the rehabilitation, if possible, of the neurological condition that allows the patient to have cooperative relationships.[68] To the extent that it is therapeutic, such use is not properly a form of or part of punishment,

[59] ROMEO, F. Giustizia e predittività. Un percorso dal machine learning al concetto di diritto. *Rivista di filosofia del diritto*. 2020, Vol. IX, No. 1, p. 107.
[60] LAVAZZA, A. Freedom of Thought and Mental Integrity, The Moral Requirements for Any Neural Prosthesis, in Frontiers in neuroscience. *Frontiers in Neuroscience*. 2018, Vol. 12, p. 82.
[61] CHURCHLAND, P. S. *Neurophilosophy: Toward a Unified Science of the Mind-Brain*. Cambridge-London: A Bradford Book, 1986, p. 71.
[62] SARTORI, G. *Neuroetica. Scienze del cervello, filosofia e libero arbitrio*. Bologna: Società editrice il Mulino, 2020, p. 19.
[63] KOLBER, A. Will There Be a Neurolaw Revolution? *Indiana Law Journal*. 2014, Vol. 89, No. 2, p. 807.
[64] SIMONCINI, A. L'algoritmo incostituzionale: intelligenza artificiale e il futuro delle libertà. *BioLaw Journal*. 2019, No. 1, p. 63.
[65] GREENE, J., COHEN, J. For the Law, Neuroscience Changes Nothing and Everything. *Philosophical Transactions of the Royal Society of London. Biological Sciences*. 2004, 1778 ss.
[66] Ibid., p. 1781.
[67] PUGH, J. Justifications for Non-Consensual Medical Intervention: From Infectious Disease Control to Criminal Rehabilitation. *Criminal Justice Ethics*. 2016, Vol. 35, No. 3, p. 205.
[68] SHAW, E. Direct Brain Interventions and Responsibility Enhancement. *Criminal Law and Philosophy*. 2014, Vol. 8, No. 1, p. 16.

nor a form of diversion of incarceration.[69] At the same time, neither can they be seen as part of a rehabilitation program in a properly legal sense.[70]

6. TOWARDS A NEW FRONTIER: BIOLAW AND NEURO-LEGAL TECHNOLOGY

The convergence of technologies that send impulses to the brain and transform signals from the brain into impulses has paved the way for the development of increasingly effective tools. The evolution of artificial intelligence applied to neuro-law has generated deep brain stimulation (DBS) devices, which are surgically implanted in the skull, and transcranial magnetic stimulation (TMS) devices, which need no surgical implantation[71]. Overall, there are the electromagnetic brain stimulation (EBS) and Brain Computer Interface (BCI) technology devices[72]. With these devices, electro-cervical activity can be monitored in real time and transformed into an output signal, which can be encoded and transmitted by means of software[73]. The new devices can adjust the intensity of stimulation according to the patient's actual condition, they can also anticipate the patient's condition and activate or adjust stimulation before an event occurs[74]. In addition, there are devices that can modulate stimulation automatically by software, totally bypassing the control of the implanted subject. The possibility of using fully automated DBS devices has sparked intense debate about their compatibility with individual autonomy[75].Using neuroimaging techniques and artificial intelligence algorithms, it has been shown that the two mental states of willfulness and guilt correspond to different brain states[76]. Through the use of functional magnetic resonance imaging (fMRI), it was also possible to predict with some accuracy (71% of the time under certain conditions) whether the subjects examined were in a conscious or reckless state, thus suggesting, as proof of principle, the possibility of inferring from brain data the legally relevant category to which a person belongs.[77]

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[69] RYBERG, J. Neurotechnological Behavioral Treatment of Criminal Offenders–A Comment on Bomann-Larsen. *Neuroethics*. 2013, Vol. 6, No. 1, p. 79.

[70] FORSBERG, L. Crime-Preventing Neurointerventions and the Law. Learning from AntiLibidinal Interventions. In: David Birks – Thomas Douglas (eds.). *Treatment for Crime. Philosophical Essays on Neurointerventions in Criminal Justice*. Oxford: Oxford University Press, 2018, p. 58.

[71] SOLBERG, L. B. Mandatory Neurointervention: A Lesser Evil Than Incarceration? *AJOB Neuroscience*. 2018, Vol. 9, No. 3, p. 148; HUBNER, D., WHITE, L. Neurosurgery for psychopaths? An ethical analysis. *AJOB Neuroscience*. 2016, Vol. 7, No. 3, p. 140.

[72] RYBERG, J. Predictive Brain Devices, Therapeutic Activation Systems, and Aggression. *AJOB Neuroscience*. 2015, Vol. 6, p. 36.

[73] CHANG, M., CANSECO, J. A., NICHOLSON, K. J., PATEL, N., VACCARO, A. R. The Role of Machine Learning in Spine Surgery: The Future Is Now. *Frontiers in Surgery*. 2020, Vol. 7, No. 54; SERB, A., CORNA, A., GEORGE, R. Memristive synapses connect brain and silicon spiking neurons. *Scientific Reports*. 2020, Vol. 10, No. 1.

[74] RYBERG, J. Deep Brain Stimulation, Psychopaths, and Punishment. *AJOB Neuroscience*. 2016, Vol. 7, No. 3, p. 168.

[75] GREELY, H. T. Neuroscience and criminal justice: Not responsibility but treatment. *University of Kansas Law Review*. 2008, Vol. 56, No. 5, p. 1103;

[76] RYBERG, J. When should Neuroimaging be Applied in the Criminal Court? *Journal of Ethics*. 2014, Vol. 18, No. 2, p. 81; ADLEMAN, N. E., MENON, V., BLASEY, C. M., WHITE, C. D. A Developmental fMRI Study of the Stroop Color-Word Task. *Neuroimage*. 2002, Vol. 16, No. 1, p. 61.

There are two hypotheses in which the brain is directly involved in the legal case.

1) In the case where persons, due to mental illness are unable to consciously participate in the judicial affair, the trial is suspended with subsequent examinations to verify the permanence of the condition, which in the event of its irreversibility determines the improbability of the criminal proceedings.
2) The right to control or alter the neurological patterns of criminals, provided that punishment implies restricting a person's autonomy even without their consent.

The second hypothesis is what really matters. On the one hand, there is a thesis in favor of mandatory neuro-correction.[78] Compulsory neurointervention is not only understood to be a lesser evil than incarceration, but it is beneficial to offenders because it can allow them to restore their autonomy in decision-making by inhibiting their criminal impulses.[79] Moreover, offenders receive full information about the effects and effectiveness of treatment by brain intervention, and their consent is truly voluntary and informed.[80] The state could be legitimized to offer this option as an alternative to incarceration or as a condition for early release. It is only necessary to establish the conditions for consent to be valid when given by individuals who are incarcerated. Moreover, consent to direct brain intervention does not eliminate the inconsistency of the goal. The use of deep brain stimulation (DBS) devices in psychopathic inmates raises questions related to bioethics and medical ethics.[81] However, there would be no substantial difference between acting directly on an offender's brain by means of drugs or devices and, indirectly, by traditional means such as cognitive therapy or incarceration.[82] Since the goal of criminal justice is not only punishment, but also to achieve something useful for society and the offender, including through rehabilitation or prevention of criminal behavior, if direct brain interventions prove sufficiently effective with an acceptable level of risk, there should be no more reason to reject them.[83] Should the offender's best interest not necessarily place a limit on nanotechnological treatment, mandatory neuro-intervention is even more permissible in the case of psychopaths or the mentally insane.[84] Both of these issues, equivalence and coercion, are also at stake in the discussion of monitoring and regulating

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[78] SHAW, E. Retributivism and the Moral Enhancement of Criminals Through Brain Interventions. *Royal Institute of Philosophy Supplement*. 2018, Vol. 83, p. 251.

[79] WALSH, E., KUHN, S., BRASS, M. EEG activations during intentional inhibition of voluntary action: An electrophysiological correlate of self-control? *Neuropsychologia*. 2010, Vol. 48, No. 2, p. 619.

[80] LAVAZZA, A. If Criminal Intentions Are Nonvoluntary, Mandatory Neurointerventions Might Be Permissible *AJOB Neuroscience*. 2018, Vol. 9. No. 3, p. 154.

[81] SAMMICHELI, L., SARTORI, G. *Neuroscienze giuridiche: i diversi livelli di interazione tra diritto e neuroscienze, in Bianchi, Gullotta, Sartori, Manuale di neuroscienze forensi*. Milano: Giuffrè, 2009, p. 15; TUCKER, M. Law and Cognitive Neuroscience. *Annual Review of Law and Social Sciences*. 2010, Vol. 6, No. 1, p. 61.

[82] CRAIG, J. N. Incarceration, Direct Brain Intervention, and the Right to Mental Integrity – a Reply to Thomas Douglas. *Neuroethics*. 2016, Vol. 9, No. 2, p. 107.

[83] PALK, A. C. Mandatory Neurointerventions Could Enhance the Mental Integrity of Certain Criminal Offenders *AJOB Neuroscience*. 2018, Vol. 9, No. 3, p. 150.

[84] MACKENZIE, R. Deep Brain Stimulation for Psychopaths–A No Brainer. *AJOB Neuroscience*. 2016, Vol. 7, No. 3, p. 137.

brain electrical activity by means of nanodevices.[85] A contrary view holds that mandatory neuro-correction is rejected because it is believed to inflict significant harm on an offender, which goes far beyond the limits of criminal punishment.[86] Some scholars have argued that the issues involved require a re-semantization of notions such as mental integrity, freedom of thought, and cognitive freedom.[87] What is problematic is the criteria for selecting who is allowed to implant these devices and whether the devices should be fully self-regulating or whether they should simply alert the implanted subject to abnormal neural activity that is prodromal to violent behavior.[88] Direct interventions undermine our sovereignty over our minds because they manipulate the neural correlates of our mental functions without any possibility of resistance.[89] Therefore, they should be declared illegal and punishable as a criminal offense because they also undermine the human right, the right to freedom of thought.[90] Compulsory neuro-corrections should be rejected as a practice that demeans recipients to a sub-human level because it treats them as objects and harms their mental and bodily integrity.[91] Where the aim is to use the results of digital risk assessment toward the defendant, without in any way being able to verify after the fact how those results were achieved, the defense will be bereft of arguments to challenge the reliability of the risk calculation, in apparent violation of precisely the principle of equality of arms. Moreover, such instruments cannot count as punishment, referring to Article 3 of the European Convention on Human Rights and the declarations of the European Court of Human Rights is a remarkably remarkable move at least in the European context. Indeed, the Court has declared that treatment or punishment is inhuman and degrading even when it causes the breakdown of the moral and physical resistance of the individual. The promotion of compulsory brain intervention involves a particular theory of punishment, the basic assumption of which is that the offender, especially in the case of violent or sexual crimes, is a deviant, that is, an abnormal and dangerous individual.[92] The goal of intervening on a personality to change it, unless this is intended as corrective or rehabilitative, is not necessarily to produce some beneficial effect on the individual, but to protect society as in a vaccination campaign. Therefore, there is no clear cut between punishment and treatment, and direct brain intervention could be mandatory or at least consensual.[93] My view is that the use of DBS devices seems a good way to overcome objections against direct brain intervention on criminals. Brain activity can be directly influenced not only by acting on electrical impulses, but also by

[85] CASEY, B. J., TRAINOR, R. J. A Developmental Functional MRI Study of Prefrontal Activation During Performance of a Go-No-Go Task. *Journal of Cognitive Neuroscience*. 1997, Vol. 9, No. 6, p. 835.
[86] RYBERG, J. *The Ethics of Proportionate Punishment. A Critical Investigation*. Dordrecht: Kluwer Academic Publishers, 2004, p. 68.
[87] COBB, M. *The Idea of the Brain: A History*. London: Basic Books, 2020, p. 101. FUSELLI, S. *Neurodiritto. Prospettive epistemologiche, antropologiche e biogiuridiche*. Milano: Mimesis, 2016, p. 105. CHURCHLAND, P. M. Eliminative Materialism and Propositional Attitudes. *The Journal of Philosophy*. 1981, Vol. 78, No. 2, p. 67.
[88] CERRONI, A., RUFO, F. *Neuroetica. Tra neuroscienze, etica e società*. Torino: Utet, 2009, p. 117.
[89] ALCES, P. A. *The Moral Conflict of Law and Neuroscience*. Chicago: University of Chicago Press, 2018, p. 97.
[90] FUSELLI, S. *Diritto Neuroscienze Filosofia. Un itinerario*. Milano: Franco Angeli, 2014, p. 72.
[91] RYBERG, J. *Neurointerventions, Crime, and Punishment*. New York: Oxford University Press, 2020, p. 49.
[92] FUSELLI, S. Mental integrity protection in the neuro-era. Legal challenges and philosophical background. *BioLaw Journal*. 2020, No. 1, p. 413.
[93] LEVY, N. *Handbook of Neuroethics*. Dordrecht: Springer, 2015, p. 1381.

drugs, which alter biochemical neurotransmission processes. Indeed, if they can be programmed to detect neural activity prodromal to aggressive behavior, they could also be put under the control of implanted subjects. In this way, subjects could choose whether or not to activate inhibitory stimuli and thus would be completely in charge of their behavior-a kind of induced consciousness. Direct brain intervention for criminals should only be voluntary. Moreover, it is necessary to consider this principle. In order to save both the mind and the brain, however, it is necessary to consider that all mental phenomena whether conscious or unconscious, visual or auditory, pain, tickling, itching, thoughts, indeed, all of our mental life, are caused by processes occurring in the brain.[94] If the external stimulus of pain were present but did not activate nerve endings in the brain, the result would be the absence of pain (this is the case with anesthesia).[95] But if stimulation of the thalamus and somatosensory cortex took place in the absence of actual external stimuli, the sensation of pain would still be perceptible.[96] Thus, mental phenomena do not result from an external object that determines them, but from changes that occur in the brain.[97]

7. CONCLUSIONS

It is clear that one can translate neuro-law with artificial intelligence. Unjust imputations and wrongful convictions can be avoided. To summarize, neuro-corrections are an unjustifiable and unacceptable harm to mental integrity because they neglect its complexity and downgrade it to a level that cannot provide a sufficient account of an individual's multifaceted willful manifestations. Whatever neuro-corrections may allow, it cannot be in the name of criminal justice, but only on the basis of the individual's informed consent. Now the open question is regarding the actual conditions for valid informed consent to assess the guarantees of therapeutic benefit, provided that the person with mens rea does not suffer subjectively and decides to choose with moral motivation.

From the analysis conducted thus far, it is undeniable that the mind is what the brain does: subjective experiences are observable from the outside and, therefore, susceptible to objective evaluation . So the elements of the crime exist only if they are verifiable as imposed by procedural verifiability, in accordance with the principles proper to rule of law. Neuroscientific acquisitions, then, could undoubtedly contribute to strengthening that constraint of reality in the management of scientific evidence. The algorithm-neuroscientific in addition to highlighting psychological profiles of the evidence by using neuroscience to distinguish false and true statements would help the judge to test the reasonable exclusion of alternative reconstructions than the one that would lead to affirmation of the defendant's responsibility, although artificial intelligence applied to evidentiary standards shows a structural weakness, since they are more future-oriented tools than to the reconstruction of past events. Finally, the algorithm could be evaluated

[94] SEARLE, J. *Minds, Brains, and Science.* Cambridge: Harvard University Press , 1984, p. 77.
[95] LEVY, N. *Neuroetica: le basi neurologiche del senso morale.* Milano: Apogeo , 2009, p. 113.
[96] SEARLE, J. *Minds, Brains, and Science.* p. 79.
[97] SEARLE, J. *Mind: A Brief Introduction.* New York: Oxford University Press, 2004, p. 89; LEVY, N. *Neuroethics: Challenges for the 21st Century.* Cambridge: Cambridge University Press, 2007.

in an adjudicative function. One example is a software capable of calculating the risk of reiteration of the crime and which, therefore, can be used as a basis for the application of pre-trial measures or alternative measures to detention as well as a tool to which reference can be made when commensuring punishment. Can unjust charges and wrongful convictions therefore be avoided? It is no coincidence that both transparency, understood as the accessibility, comprehensibility and external verifiability of the computational processes used in the judiciary, and the prohibition of creating or accentuating, by means of algorithms, discrimination against groups or individuals, are among the fundamental principles identified in the 'European Ethical Charter for the Use of Artificial Intelligence in Criminal Justice Systems and Related Environments,' drafted, within the framework of the Council of Europe, by the European Commission for the Efficiency of Justice (CEPEJ).[98] In light of the theories outlined above, it can be concluded that there will soon exist an algorithm, a machine that will replace the human judge in writing reasons for judgments with the most natural outcome of the disappearance of motivation. In fact, through the decision of an algorithm, reliable, motivation would become superfluous: the robot judge is not only capable of reasoning like a human being, but can be programmed in such a way as to exclude the heuristics and cognitive biases that, in an almost inevitable way, condition human conduct, even that of a judge. In conclusion, the judge-algorithm would be faster, more efficient, with fewer biases, capable of rendering predictable decisions and, thus, make a significant contribution (at least) to a stabilization of jurisprudence. Assertions that cannot be supported here, in this analysis, because without regularization that protects the inviolable rights of the defendant's rights and more generally the inviolable rights of man, there would be chaos in the apparent cosmos of the AI universe, through the censorship of the interpretation of law and legal hermeneutics.

[98] QUATTROCOLO, S. Intelligenza artificiale e giustizia: nella cornice della Carta etica europea, gli spunti per un-'urgente discussione tra scienze penali e informatiche. *La Legislazione penale*. 2018, p. 2.