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The Role of Blockchain in Managing Neuroscientific Evidence and Its Impact on Cognitive Liberty

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Abstract: **The Role of Blockchain in Managing Neuroscientific Evidence and Its Impact on Cognitive Liberty**
The subject of neuroscience is the study of the relationship between the human brain and human behavior. With the recent advancements, Neurosciences study topics are generating different opportunities to help us with increasing possibilities to monitor, influence, and control human brain processes. In this article, we analyzed how this possibility of incorporating neuroscience in legal frameworks is changing into a concrete reality to be able to control socially unwanted behavior. It motivates us to study the relationship between neuroscience and neurolaw with a special focus on blockchain technology's role in the neurolaw context. With this perspective, we demonstrated the potential role of neuroscientists in Courts and blockchain for neuroscientific evidence. Secondly, we analyzed how this intervention of new neuro-paradigms in public, debates about the structure of Society and the Law. In this article, we then focused on the domains of so-called reductive neurolaw, which comes with an idea of the gradual replacement of traditional sources of law with new emerging neuro-scientific standards. Along with this, we discuss a definition of Cognitive Liberty (a new form of safeguard) able to be collected in a "Declaration of Human Neuro-rights" in fact, cognitive liberty may be employed as a novel conceptual weapon to defend individual human rights from neuro-paradigms that reduce them to nothing. Finally, we discussed how blockchain is revolutionizing cognitive liberty and neurolaw.

Keywords: Neuroscience, Reductive Neurolaw, Neuro-deviance, Cognitive Liberty, Human Rights, Blockchain Technology.

1. Introduction

Neuroscience is the scientific field that investigates the relationship between the human brain (and nervous system) and human behavior. In this work, we will

* This essay is a product of a cooperative work of Paolo Sommaggio and Shan Ali, anyway, for any purpose, the § 1-5 are Paolo Sommaggio's and § 6-10 Shan Ali's.

briefly examine the possibility that knowledge of neurological structures will be used to influence social behavior[1] thus paving a new way for neurocivilization[2].

In doing so, we will demonstrate reductive neurolaw, which is the gradual replacement of traditional sources of law with new neuroscientific standards, along with the concept of cognitive Liberty that stands as a conceptual tool capable of defending people from direct brain intervention, which raises critical concerns about human autonomy and personal freedom[3]. Furthermore, we will demonstrate how this concept plays an important role in a new international human rights framework. Finally, we will address the role of blockchain technology in neuroscientific evidence and cognitive liberty.

2. The New Technologies

New techniques for studying the human brain have opened up previously unthinkable possibilities for directly knowing and directing people's actions. In this section, we present a quick summary of current neuro-technologies and the kind of questions that their development and implementation raise.

The first category of neurotechnologies we consider is brain imaging techniques. The primary techniques used for brain monitoring and imaging are electroencephalography (EEG) and functional magnetic resonance imaging (FMRI). They give anatomical and functional information about the brain and its neural activity, which is employed in diagnostic and research applications. Neuroscientists, for example, can use FMRI to analyze how neurons fire, allowing them to link brain activity with mental activity and localize parts of the brain that respond to specific stimuli, such as pain or language recognition. This material provides a better understanding of how the brain functions and how it supports our thinking.

The next group of technologies includes neuro-stimulation, which provides therapies based on electrical and magnetic stimulation of the brain via medical devices mounted to the head or implanted into the brain. Transcranial Magnetic Stimulation (TMS) and Deep Brain Stimulation (DBS) are currently widely used in the treatment of neurological and psychiatric illnesses such as Parkinson's disease, epilepsy, and depression[4].

A third set of neuro-technologies comprises psychoactive drugs, which are known to cause personality changes too. The last issue that will be touched upon

[1] A. Roskies, "Neuroethics for the New Millennium", in *Neuron*, 35 (2002), n. 1, pp. 21-23.
[2] P. Sommaggio, M. Mazzocca, A. Gerola, F. Ferro, "Cognitive liberty. A first step towards a human neuro-rights declaration", in *BioLaw Journal*, 3 (2017), pp. 27-45.
[3] *Ibidem*.
[4] F. Jotterand, J. Giordano, "Transcranial magnetic stimulation, deep brain stimulation, and personal identity: ethical questions, and neuroethical approaches for medical practice", in *International Review of Psychiatry*, 23 (2011), n. 5, pp. 476-485.

here is cognitive enhancement. Both neuro-stimulation technologies and psychoactive drugs can be used to augment human cognitive capacities such as attention, focus, and memory (but also mood, personality traits, and behavior).

Therefore, we can sum up the idea of effective neuroscientific technologies that can read the minds of people, inducing a change in the mood and personality of subjects to which it is implied. An ideal neuroscientific technology can modify behavior and alter the formation of memory and its consolidation with an additional ability to be able to argue the cognitive ability. These are the reasons why the field of neuro-ethical needs is bringing about the necessity of an ever-increasing consideration of social and ethical implications of neuro-technological discoveries[5].

3. Radicals & Reformists

In the 1990s, neurosciences began to make their way into the public eye in pursuit of recognition, coining the term "Decade of Brain" (Presidential Proclamation 6158, Office of Federal Register, 12:11 p.m., July 18, 1990)[6]. A recent article focuses on how neurosciences can support the efficient and equitable administration of justice. The authors make the assumption that, at this time, neurosciences have displaced all other scientific disciplines and fundamentally altered the conventional methods of conceptualizing the anthropological events that serve as the foundation for legal systems. This will allow neuroscientists to surpass all other specialists in their field in terms of qualification for all in-depth technical examinations held in court[7].

Additionally, we observe the slow emergence of stereotypes and popular notions that have the power to sway discussions in the social and political spheres[8]. This initiative aims to integrate classic anthropological and moral conceptions, such as free will and conscious moral action, which form the foundation of all legal orders, with the latest advancements in neuroscience[9]. The conclusion is straightforward: discoveries in neuroscience require the modification of existing

[5] W. Sententia, "Freedom by design: Transhumanist values and cognitive liberty", in M. More, N. Vita-More (eds.), *The Transhumanist Reader: Classical and Contemporary Essays on the Science, Technology and Philosophy of the Human Future*, John Wiley & Sons, Hoboken, 2013, pp. 356-357.

[6] J.T. Cacioppo (ed.), *Foundations in Social Neuroscience*, Massachusetts Institute of Technology Press, Cambridge, 2002; D.D. Franks, *Neurosociology. The Nexus Between Neuroscience and Social Psychology*, Springer, Dordrecht, 2010; C. O'Connor, G. Rees, H. Joffe, "Neuroscience in the public sphere", in *Neuron*, 74 (2012), n. 2, pp. 220-226.

[7] O.D. Jones, A.D. Wagner, D.L. Faigman, M.E. Raichle, "Neuroscientists in court", in *Nature Reviews Neuroscience*, 14 (2013), n. 10, pp. 730-736.

[8] A. Kolber, "Will There Be a Neurolaw Revolution?", in *Indiana Law Journal*, 89 (2014), n. 2, pp. 807-845. D. Larriviere, M.A. Williams, "Neuroenhancement: Wisdom of the Masses or 'False Phronesis'?", in *Clinical Pharmacology&Therapeutics*, 88 (2010), n. 4, pp. 459-461.

[9] M. Farah, "Emerging ethical issues in neuroscience", in *Nature Neuroscience*, 5 (2002), n. 11, pp. 1123-1130.

legal orders. This is a premise held by many neuroscientists, albeit their approaches to changing the law vary. The outcome is very simple: legal orders must be modified according to new neuroscientific achievements.

One group believes that the introduction of neurosciences into the study of law will inevitably result in a revolution of legal systems into modern legal frameworks. These individuals are known as maximalists or radicals[10]. Conversely, reformists believe that it is more beneficial to alter the legal systems gradually and consistently, without causing undue stress to society, by small but consistent reforms[11].

The reason we believe Greene and Cohen[12] embody the radical position is that they justify their support for the introduction of neuroscientific technologies into legal orders by pointing out that doing so will eliminate free will and the concept of responsibility that comes with it. These ideas are outlined in the theories of punishment, particularly the retributivist one[13]. To date, however, the enthusiasts have favored workable solutions over precisely defining the standards to which a subject should be treated[14].

Stephen Morse is unquestionably among the composed reformists who acknowledge the introduction of neuroscience as being somewhat beneficial without endorsing it blindly. Morse thinks the new accomplishments won't be able to completely transform the legal system. In reality, he believes that the legal systems cannot be directly affected by the rapid expansion of neurosciences in the near future, at least not significantly. According to Morse, it is incorrect to absolve someone of responsibility for their actions solely because "his/her brain did it". Individual responsibility cannot be questioned unless some altered state is highlighted, as every action we take is in some way caused by the brain. This is so because the foundation of law is common sense psychology, which is immune to the influence of neuroscientific findings. This is especially true for criminal penalties, which are based on a "folk-psychological" understanding of the offender and their behavior[15].

The psychological theory of Morse explains behavior that is somewhat influenced by biological, psychological, and societal factors and partially by mental states including intents, beliefs, and plans. In conclusion, folk psychology views mental states as essential to an understanding of the fundamentals of human psychology. "Folk psychology presupposes only that human action will at least be

[10] M.S. Gazzaniga, M.S. Steven, "Free Will in the Twenty-first Century", in B. Garland (ed.), *Neuroscience and the Law: Brain, Mind and the Scales of Justice*, Dana Press, New York, 2004.
[11] N. Vincent, "On the Relevance of Neuroscience to Criminal Responsibility", in *Criminal Law and Philosophy*, 4 (2010), pp. 77-98.
[12] J. Greene, J. Cohen, "For the law, neuroscience changes nothing and everything", in *Philosophical Transactions of the Royal Society B: Biological Sciences*, 359 (2004), n. 1451, pp. 1775-1785.
[13] M. Pardo, D. Patterson, "Neuroscience, Normativity, and Retributivism", in T. Nadelhoffer (ed.), *The Future of Punishment*, Oxford University Press, Oxford, 2013, pp. 133-154.
[14] A. Kolber, *op. cit.*, pp. 807-845.
[15] S.J. Morse, "Compatibilist Criminal Law", in T. Nadelhoffer (ed.), *op. cit.*, pp. 107-132.

rationalized by mental state explanations or will be responsive to reasons including incentives under the right conditions"[16].

This is why, in Morse's idea neurosciences will not modify the law in a revolutionary way, as the latter is founded on premises tied to common sense and not to techno-scientific explanations.

4. Neurolaw

The intervention of new neurolaw in the modern era has two important components, which ensure the traditional society's transition into a neuroscientific one. The first is to create new legal regulations based on advances in neuroscience; the second is the ability to directly alter someone's brain (i.e., therapeutically or sanctioningly). Regarding the first component, it is achieved by substituting new neuroscientific norms for established legal sources. This is because neuroscientists believe that legislation, which was designed as a traditional method of social control, has failed since it cannot ensure the upkeep of order in society[17]. On this topic, Brian Tamahana wrote:

> Under a scientific view, law would come instead to be seen as the source of social order – to produce social order is the function or purpose or end of law. In turn, this new perspective, over time, would open up questions about the efficiency and utility of law in carrying out its functions. The subtle but fundamental difference can be put thus: law is order, versus law maintains order[18].

For the second part regarding the alteration of the brain under the umbrella of new neurolaw, David Eagleman claims that, about the second aspect of neurolaw, criminal subjects ought to be handled as people who suffer from serious illnesses or cognitive impairments. Eagleman's recommended rehabilitative methods rather than punitive ones are grounded in non-invasive behavior modification techniques like neuroimaging, which functions as a kind of biofeedback that enables people to view images of their brains and gain more control over their behavior. "To achieve this, we have started utilizing real-time feedback to participants during brain imaging", he added. Through the use of this strategy, individuals can become aware of when their brain is experiencing cravings and learn how to regulate (in this

[16] S.J. Morse, "The status of neurolaw: A plea for current modesty and future cautious optimism", in *The Journal of Psychiatry & Law*, 39 (2011), n. 4, pp. 595-626.
[17] S.J. Morse, "Mental disorder and criminal law", in *Journal of Criminal Law & Criminology*, 101 (2011), n. 3, pp. 885-968.
[18] B.Z. Tamanaha, *Law as a Means to an End: Threat to the Rule of Law*, Cambridge University Press, Cambridge, 2006, p. 21.

example, decrease) that neural activity by fortifying other, long-term decision-making mechanisms[19].

As a scientific theory of the basis of new neurolaw, these postulates are intriguing, but when tested, they are shown to be only subjective choices. Despite this, the new "neurolaw" is founded on neuro-standards but yet they hold a significant deal of confusion. Therefore, one of the neurolaw's most sensitive topics is the definition of agreed norms. Stated differently, there is a lack of consensus among us regarding the definition of a "criminal", such as whether it stems from a desire to violate moral or legal obligations, a biological trait, or a specific illness. Maybe a new normal is emerging one that isn't the same as the old one. A substitute that is quite difficult.

5. Neurorights

According to Rainey and Yang[20] the most popular framework in neurolaw is very straightforward: human behavior has a biological basis, and since this basis is modifiable, it is possible to control the biological matrices of socially unacceptable behavior. The method is fairly straightforward: all that is needed to conceptualize social abnormalities is to view them as biological (brain) abnormalities, placing them under the umbrella of mental disorders and diseases. Given that the law, particularly criminal law, does not seem to be the best tool for solving the issue, society must make room for alternative, more successful approaches (of neurolaw)[21].

By using different novel "therapies" (such as surgery, medications, brain transplants, etc.), it is feasible to modify the deep brain structure and mental states in several ways, which can regulate behavior more efficiently and prevent illegal activities than incarceration or other treatments. Stated differently, it appears that the road towards a society that is more neuro-standardized will be rather easy and gentle[22]. By implementing "deviance" will be reduced to a straightforward health issue that is created by neurostandards (neurorules) and addressed with neurotechniques.

[19] D.M. Eagleman, S. Isgur Flores, "Defining A Neurocompatibility Index for Criminal Justice System: A Framework to Align Social Policy with Modern Brain Science", in S. Muller *et al.* (eds.), *The Law of the Future and the Future of the Law: vol. II*, Torkel Opsahl Academic publisher, The Hague, 2012, pp. 161-171.

[20] A. Raine, Y. Yang, "Neural foundations to moral reasoning and antisocial behavior", in *Social Cognitive and Affective Neuroscience*, 1 (2006), n. 3, pp. 203-213.

[21] H. Nagera, "Reflections on Psychanalysis and Neuroscience: Normality and Pathology in Development, Brain Stimulation, Programming and Maturation", in *Neuropsychoanalysis*, 3 (2013), n. 2, pp. 179-191.

[22] I.A. Singh, W.P. Sinnott-Armstrong, J. Savulescu, *Bioprediction, Biomarkers, and Bad Behavior. Scientific, Legal and Ethical Challenges*, Oxford University Press, Oxford, 2013.

We believe it is important to emphasize how this scientific framework of using neurotherapies may move dangerously toward individual freedom. It is a result of the lack of agreement. It is well known that many legal orders including different types of intervention, such as forced medical procedures, are carried out even when the subjects of the orders do not consent to them. In our opinion, this blind spot may serve as a test bed for novel normalization strategies influenced by neuro-civilization or, more accurately, neuro-normalization during the coming years[23].

As one of the most ardent proponents of neuro-civilization, Hank Greely attempted to initiate a discussion in 2012 regarding the use of involuntary treatments specifically for the modification or removal of antisocial behavior, as well as for the treatment of illnesses and psychological discomfort[24].

Greely makes the audacious claim that neurosciences will enable the modification of undesirable behavior by altering the neural underpinnings of individual agents. This logic is quite straightforward: if we concur that direct brain intervention is appropriate in cases of severe illness or disability, then there is no justification for disagreement over the management of brain-related factors that contribute to socially undesirable behavior. Greely suggests using efficacy and safety as benchmarks when assessing various neuro-treatment options. He claims that because conventional direct brain intervention techniques, including lobotomies, are neither safe nor successful, they are oversimplified answers to an extremely complicated issue[25].

To eliminate socially unacceptable behavior through behavior management, it is therefore required to evaluate novel kinds of safe and effective intervention given, however, that the interventions are safe, effective, and not inappropriate. According to him, there is no need for the controversy brought about by a change in a person's brain if we can calmly put someone in jail for trying in vain to change their behavior.

The issue is one of individual freedom, namely the "resistibility" of conventional methods that grant the subject some residual autonomy, which the new methods of direct intervention would not grant. Greely states that in this context, it is necessary to define an unreachable "cognitive liberty" – a kind of privacy threshold that one should not descend. The more successful (and seductive) the treatment, the greater the invasion of liberty, he argued. "Resistible" treatments, like prison rehabilitation programs, nonetheless seem to leave some freedom for choice". We agree that there should be a protected area for cognitive liberty, but

[23] G. Meynen, "A Neurolaw Perspective on Psychiatric Assessments of Criminal Responsibility: Decision-making, Mental Disorder, and the Brain", in *International Journal of Law and Psychiatry*, 36 (2013), n. 2, pp. 93-99.
[24] H.T. Greely, "Neuroscience and criminal justice: not responsibility but treatment", in *Kansas Law Review*, 56 (2008), n. 5, pp. 1103-1138.
[25] *Ibidem*.

since all interventions have an impact on the brain, it is difficult to understand why required brain interventions should only be prohibited if they are direct[26].

However, even with this kind of unachievability, it is hard to claim that direct brain intervention could not spread like wildfire as a way to ease approved behavior or change socially undesirable or unaccepted behavior. Though we can only trace a preliminary outline, these considerations bring up an intriguing prospect of in-depth study. The idea of cognitive liberty, often known as the right to mental self-determination, has just recently entered the discourse on a global scale[27]. Cognitive liberty is associated with the idea of sovereignty over one's "cognitive heritage" and would entail a right akin to the inviolability of the brain against the state or outside parties. However, it emphasizes on enhancement of one's cognitive structure[28] by having freedom for direct interventions[29].

6. Blockchain for Neuroscientific Evidence

The incorporation of blockchain technology into legal systems has signified a substantial advancement in the management of neuroscientific evidence. Blockchain technology has proved itself to be the most promising technology in revolutionizing the mechanism by which evidence is well managed thus offering unmatched reliability, security, and ethical surveillance.

The importance of neuroscientific findings in establishing judicial decisions has increased magnificently and this increase has created the need for absolute data integrity and trustworthiness as the most critical element. A unique decentralized nature is a basic characteristic of blockchain technology and it has equipped, modern judicial setups with the capacity for creating an immutable record that ensures the permanence and inalterability of data once it is stored. This foundational characteristic is pivotal in addressing some of the top concerns around the authenticity and precision of neuroscientific evidence, as noted[30].

Blockchain technology can preserve the data integrity once stored, which is an essential component for neuroscientific evidence, as it plays a very significant role in influencing legal outcomes. The immutable ledger of blockchain technology guarantees that when the data is recorded under its umbrella, the data is immune to any kind of alteration, thereby setting a robust and dependable basis for judicial

[26] H.T. Greely, "Direct Brain Interventions to 'Treat' Disfavoured Human Behaviours: Ethical and Social Issues", in *Clinical Pharmacology & Therapeutics*, 91 (2012), n. 2, pp. 163-165.
[27] J. Bublitz, "My mind is Mine!? Cognitive Liberty as a Legal Concept", in E. Hildt, A. Francke (eds.), *Cognitive Enhancement*, Springer, Dordrecht, 2013, pp. 233-264.
[28] Wrye Sententia and Richard Glen Boire are the founders of the Centre for Cognitive Liberty and Ethics (CCLE).
[29] W. Sententia, "Neuroethical Considerations: Cognitive Liberty and Converging Technologies", in *Annals of the New York Academy of Sciences*, 1013 (2004), n. 1, pp. 221-228.
[30] M. Crosby, Nachiappan, P. Pattanayak, S. Verma, V. Kalyanaraman, "Blockchain technology: Beyond Bitcoin", in *Applied Innovation*, 2 (2016), pp. 6-10.

decisions and outcomes. With any kind of neuroscientific data its privacy that comes along with its sensitive nature, is also a key concern. Blockchain technology can adeptly meet the privacy requirements through different state-of-the-art encryptions and pseudonymization techniques which ensures compliance with stringent privacy standards like the GDPR, as reported by Zyskind, Nathan, & Pentland[31].

Blockchain technology has its characteristic feature of facilitating the conception of standardized protocols for the submission and storage of data related to neuroscientific evidence. The standardization of protocols for data management under blockchain technology is very crucial for mitigating discrepancies in the handling of evidence and their evaluation across various legal jurisdictions, and as a result, it promotes fairness and consistency in undergoing different legal proceedings[32]. This technology also encourages the exploration and implementation of a collaborative verification process among all the stakeholders in the legal chain that starts from the neuroscientists moving to legal professionals, and law enforcement agencies. This implementation ensures the enhancement of the credibility and reliability of neuroscientific evidence in different legal contexts presented under different scenarios[33].

Despite its advantages, we are met with different challenges while adopting blockchain in legal contexts including the need for digital literacy among all legal professionals. Blockchain technology has faced resistance from traditional legal systems. Another important implication of this technology is its necessity to have evolved regulatory and ethical frameworks which can be an important setback presently in implementing blockchain technology in the management of neuroscientific evidence.

7. Cognitive Liberty as a Neuroright

The classical definition of "liberty of thought" is frequently expanded upon using the phrase "Cognitive Liberty". Currently, meanwhile, some academics are using that phrase to argue against democratic legal systems' incorporation of such a right into their constitutions[34]. This later definition highlights three important conceptual points:

[31] G. Zyskind, O. Nathan, A. Pentland, "Decentralizing privacy: Using blockchain to protect personal data", in *Proceedings of the IEEE Security and Privacy Workshops*, 2015, pp. 180-184.
[32] P. Mamoshina, L. Ojomoko, Y. Yanovich, A. Ostrovski, A. Botezatu, "Converging blockchain and next-generation artificial intelligence technologies to decentralize and accelerate biomedical research and healthcare", in *Oncotarget*, 9 (2018), n. 5, pp. 5665-5690.
[33] D. Tapscott, A. Tapscott, *Blockchain revolution: How the technology behind Bitcoin is changing money, business, and the world*, Portfolio, London, 2016.
[34] W. Sententia, "Freedom by design: Transhumanist values and cognitive liberty", cit., pp. 356-357.

- *Privacy*. Which is to say, our thoughts must be private unless we choose to share.

- *Autonomy*. In light of this, every human being needs to be able to exercise free will and all of their mental abilities

- *Choice*. Which is why the human mind's capacity shouldn't be restricted.

In any case, however, it should be noticed how to present the possibilities of a brain intervention (permanent or not) as an alternative to imprisonment integrates implicit coercion to the individual's will[35].

On the other hand, a pro-Cognitive Liberty stance contends that everyone who desires access to current neurotechnologies should have them readily available[36]. A cognitive enhancement may result from the free personal use of psychoactive substances and cognitive devices (e.g., transcranial direct current stimulator or neurofeedback equipment)[37]. However, the concept of enhancement may be related to both a hypothetical individual level (e.g., improving one's memory) and a hypothetical general level (e.g., drug treatment during academic exams).

This new position states as follows: to the point till one person is not directly harming others, cognitive enhancement should not be intervened or prohibited by the states or governments. This new stance says that governments shouldn't forbid cognitive enhancement or the manifestation of any other mental state until one individual directly harms others. On the other hand, even while society may view the use of these "treatments" as morally acceptable, there is little data to support their effectiveness, and there may be long-term safety concerns that would warrant caution. The dispute between transhumanists and conservatives is likewise based on this divide.

The first part aims to "create the opportunity to live much longer and healthier lives, to enhance our memory and other intellectual faculties, to refine our emotional experiences and increase our subjective sense of well-being, and generally to achieve a greater degree of control over our own lives", the second part made the argument that the use of cognitive enhancement could have unanticipated and profound effects on society because it might enable people to develop cognitive structures that are outside the normal range of human experience[38].

And that's exactly it: a common definition of "normality" hasn't been developed, or we can say what neuro normality the other way is still to be defined. The statistical model, which is based on the observation of behavioral uniformity, and the socio-biological, or evolutionary, model are the two formulae that relate to

[35] M. Farah, *op. cit.*, pp. 1123-1130.
[36] N. Bostrom, A. Sandberg, "Cognitive Enhancement: Methods, Ethics, Regulatory Challenges", in *Science and Engineering Ethics*, 15 (2009), pp. 311-341.
[37] H. Maslen *et al.*, "The regulation of cognitive enhancement devices: extending the medical model", in *Journal of Law and the Biosciences*, 1 (2014), n. 1, pp. 68-93.
[38] G. Lynch *et al.*, "The Likelihood of Cognitive Enhancement", in *Pharmacology Biochemistry and Behavior*, 99 (2011), n. 2, pp. 116-129.

normalcy in the neuro-scientific context[39]. Still, there are arguments against both theories. The statistical syndrome known as the bell curve, which is a standardized data distribution where there is one stupid for every genius, undermines any concept of normalcy in the case of empirical observation.

One could criticize the second one of using the approach of cognitive enhancement because it ends up in a dead end, making it impossible to identify the circumstances under which a particular behavior may have been a "good" or "bad" adoption to the context of social behavior. Thus it goes without saying that there are strong arguments in favor of the use of cognitive potentials being justified by our autonomy in determining our own identity and conscience. Still, a common criticism of cognitive augmentation emerges, even if we adopt a libertarian perspective. Since cognitive enhancement with the help of neuroscientific enhancers has the potential to be a very large market, the wealthy will have access to it while the poor will not, leading to even greater social divides. Since it represents a potentially huge market, not only for drug companies but also for physicians who might enter the potentially lucrative market, especially cosmetic neurology[40]. Furthermore, it raises the question of whether the availability of enhancers would not impose professional obligations on those in high-risk occupations (like pilots or surgeons) to use them even if there is plausible doubt regarding their effectiveness and potential drawbacks[41].

8. Neuro Human Rights

It has been observed that neurotechnologies have proved themselves with bearing capacity to influence and reshape legal frameworks, even though international human rights law has not yet directly addressed neuroscience[42]. This presents an issue. When considering global society from a broader perspective, we might argue that neurotechnologies have the power to completely change our understanding of it. They have the power to affect every individual, which explains why. Or, to put it another way, they have the power to alter every person's internal cognitive structure. This raises international and, in fact, human rights concerns.

The debate over the fundamentals of human rights interests us a little, therefore we'll stick to definition of human rights in this essay. According to Beitz (2011), human rights are mandated "to protect urgent individual interests against

[39] P. Sommaggio, "Neuro-civilization: A New Form of Social Enhancement", in *ATINER'S Conference Paper Series*, n. SOS 2016-2106, pp. 3-18.
[40] J.J. Giordano, "Neuroethical issues in neurogenetic and neuro-transplantation technology: The need for pragmatism and preparedness in practice and policy", in *Studies in Ethics, Law, and Technology*, 4 (2011), n. 3 (https://doi.org/10.2202/1941-6008.1152).
[41] H. Maslen *et al.*, *op. cit.*, pp. 68-93.
[42] P. Sommaggio, M. Mazzocca, "Cognitive Liberty and Human Rights", in A. D'Aloia, M.C. D'Arrigo (eds.), *Neuroscience and Law*, Springer, Berlin, 2020, pp. 95-111.

predictable dangerous ('standard threats') to which they are vulnerable under typical circumstances of life in a modern world order composed of states". In our opinion, cognitive liberty satisfies all of Beitz's criteria. This is because cognitive liberty can be understood as a prerequisite to safeguard the mind's autonomy against the interference of other entities (including the state), and this component is a fundamental aspect of the entire world[43].

Similar reasoning might be applied to prevent the so-called "rights inflation", which is the conventional argument against the acknowledgment or development of further human rights. To determine if these new rights are legitimate human rights, we apply a justificatory test. Nobody, we suppose, could contest the fact that Cognitive Liberty addresses a common and grave threat to a very important good. However, in the majority of countries, no one can prohibit its use or cast doubt on its viability. One could refer to this as the Nickel test. The prerequisites for the Nickel test are also included in Cognitive Liberty. Because of this, we believe that Cognitive Liberty can effectively "overcome" the issue of the inflation of human rights. Similar to this, Ienca and Andorno's investigation centers on the rejection of the coercive application of neurotechnologies and the creation of the legal category of Cognitive Liberty, both of which need to be backed by the introduction of new human (neuro) rights or the reinterpretation of already-existing human rights that includes the freedom of cognition, the right to psychological continuity, the right to mental integrity and the absolute right to mental privacy.

It has been summarized that:

> In this paper, we will primarily focus on the negative formulation of the right to cognitive liberty, which is the freedom to refuse coercive applications of neurotechnology, for our analysis. Furthermore, we contend that although the concept of the right to cognitive liberty has been introduced, it is insufficient on its own to address all of the ethical and legal ramifications that are connected to neurotechnology. Instead, a simultaneous reinterpretation of already-existing rights or even the development of brand-new, neuro-specific rights should be synchronized with the recognition of cognitive liberty as a human right. This includes the rights to psychological continuity, mental integrity, and privacy[44].

In consideration of the first point, the question that arises is whether actual standards of privacy protection include the information included in or generated by our mind[45].

[43] C.R. Beitz, *The idea of human rights*, Oxford University Press, Oxford, 2011.

[44] M. Ienca, R. Andorno, "Towards new human rights in the age of neuroscience andneurotechnology", in *Life Sciences, Society, and Policy*, 13 (2017), n. 1, pp. 1-27.

[45] A possible protection is provided by the European Convention on Human Rights in Article 8, which recognizes the right to respect family life, domicile and correspondence and co. 2 states: "There shall be no interference by a public authority with the exercise of this right except such as is in accordance with the law and is necessary in a democratic society in the interests of national

An additional issue is that of criminal organizations' attacks on the brain. In the same manner that computer hackers influence brain capacities and the ensuing mental integrity, they can do the same with neurological devices. Since Article 3 of the European Charter of Human Rights emphasizes the right to health and biology, everyone is aware that bodily and psychological integrity is currently protected biologically[46]. The protection of the mental component from potential injury by others, as well as facilitating easy access to psychiatric therapies and assistance for people with mental health difficulties, are two goals of mental integrity. A distinct regulatory safeguard against potential neurochemical therapies intended to permanently alter an individual's personality with direct cognitive damage should result from this reexamination of mental integrity.

Based on Article 8 of the European Convention on Human Rights and acknowledged by the Universal Declaration of Human Rights, the European Court of Human Rights devised a neurological specification about the right to personal identity, which is known as the right to psychological continuity. Art. 22 and 29 herein explain the right to personal fulfillment and the full development of personality. Either way, approval of deliberate encroachments into personal space requires careful consideration and extensive public discussion[47].

Consequently, while they believe that Cognitive Liberty is a necessary condition for all rights about neuro aspects, we believe that, in light of their logic, it would be better to forego incorporating a new neuro-oriented right into the existing human rights declarations and instead concentrate on creating a completely new Declaration of Human Neuro-rights.

We believe we could claim a Universal Declaration on Neuro-Rights, just like we did with the idea of the Human Genome. This is due to the adaptability that human rights law has demonstrated in addressing the issues raised by genetic technology, which suggests that it could be a helpful tool to predict how this issue will change over the coming years. The route can resemble a step on a staircase, which is comparable to the debate over genetic concerns. It didn't take long for genetic issues to get international protection. The goal of preserving genetic privacy (against uses incompatible with human rights) and safeguarding the human genome led to the adoption of the Universal Declaration on the Human Genome and Human Rights in 1997. An International Declaration on Human Genetic Data was created in 2003 that outlined these ideas. Human rights and bioethics issues are closely related, as the 2005 Universal Declaration on Bioethics and Human Rights further clarified. Thus, we believe that, in contrast to what Bublitz and Ienca-Andorno have

security, public safety or the economic well-being of the country, for the prevention of disorder or crime, for the protection of health or morals, or for the protection of the rights and freedoms of others".

[46] However, it is necessary to recognize that the rights of the Charter apply only to the institutions, agencies and bodies of the Union respecting the principle of subsidiarity as well as to Member States in the implementation of Union law, as stated in art. 51.

[47] M. Ienca, R. Andorno, *op. cit.*, pp. 1-27.

written, it would be not only preferable and just but also simpler to resolve the issues surrounding the concept of Cognitive Liberty by creating a new Declaration of Human Neuro-Rights and following the already established path about the Human Genome[48].

9. Blockchain in Neuro-Law and Cognitive Liberty

The modern concept of neuro-law emerges with the fusion of neuroscience and legal frameworks that establish a complex set of challenges and opportunities in the face of rapid technological evolution. Cognitive liberty is one of the essential elements of neuro law, which emphasizes the right to privacy, autonomy, and control over one's mental state. The concept of cognitive ability has become increasingly relevant with the development of the latest neurotechnologies that have the potential to alter and monitor human brain activity. Blockchain technology in this context has emerged as a critical enabler in reinforcing different neuro-legal frameworks and ensuring the protection of cognitive liberty through evolving mechanisms for secure consent management, ethical data sharing, and transparent governance of neurotechnology applications[49].

In neurolaw, consent management is an important legal and ethical issue within neurotechnological applications that demands quick and efficient mechanisms to ensure that the consent under consideration is informed, voluntary, and reversible. Blockchain provides a novel solution to the emerging challenges relating to consent management by leveraging smart contracts and immutable ledgers that can create transparent, incontrovertible records of user consent. This approach of preserving consent management has significantly enhanced individual autonomy and control over participation in neurotechnology studies or therapies[50]. The idea of regulating consent management under blockchain regulation aligns with legal consent standards that ensure compliance with the requirements of being informed, specific, and documented and can address this crucial aspect of neuro-law[51].

The sharing of neural data presents significant privacy concerns and emphasizes establishing a balance between advancing scientific research and ensuring the protection of individual privacy regarding neural data. With blockchain technology implementation we can offer a secure and decentralized platform for data sharing that safeguards the confidentiality and integrity of neural

[48] *Ibidem*.
[49] J. Rosen, B. Wittes (eds.), *Constitution 3.0: freedom and technological change*, Brookings Institution Press, Washington DC, 2011.
[50] G. Zyskind, *op. cit.*, pp. 180-184.
[51] S. Wachter, B. Mittelstadt, L. Floridi (2017), "Why a right to an explanation of automated decision-making does not exist in the General Data Protection Regulation", in *International Data Privacy Law*, 7 (2017), n. 2, pp. 76-99.

data. Blockchain technology has different encryptions and smart contracts, and by employing them, it can establish a controlled environment for ethical and responsible data sharing, contingent upon explicit consent from data subjects. The advancement with blockchain technology in securing the privacy of neural data not only meets different ethical and legal standards but also increases the trust and transparency among research participants and scientists, further demonstrating blockchain's utility in neuro-law[52].

Another striking feature of blockchain technology is its capacity for transparent and immutable transaction recording. It provides an unmatched opportunity for governing neurotechnology applications. By precisely documenting each use case and ensuring compliance with established ethical guidelines, blockchain introduces a new level of accountability, supporting regulatory bodies in enforcing legal and ethical standards. With this idea, blockchain technology can offer a workable framework for auditing and compliance verification which can increase public trust and confidence in neurotechnologies[53].

Summarizing the implementation and impact of the adoption of blockchain technology within neuro-law, we can say that this synchronization if achieved can leap a monumental shift to more secure, transparent, and accountable neurotechnology practices. By ensuring and incorporating robust consent management, ethical data sharing, and effective governance, blockchain can offer a workable and comprehensive solution to the challenges posed by neurotechnology advancements. This pioneering strategy of synchronizing blockchain technology in neurolaw not only safeguards cognitive liberty but also lays the basis for the responsible development and application of neurotechnologies. The continued and evolving collaborations among neurotechnologists, legal professionals, and ethicists will be fundamental in maximizing the potential of blockchain to protect cognitive freedoms in an increasingly digital age.

10. Conclusions

The writers we showcased have a joint neuroscientific endeavor: that unfolds mechanisms of a legal and societal improvement. A kind of "neurocivilization", where new neuroscientific norms are used in place of legal precedents, and illegal behavior is eradicated through direct brain stimulation. A harmonious future for a "better" society is promised by the neuroscientific social structure, which stigmatizes undesirable (non-normal) behavior. This is the point: where traditional

[52] M. Ienca, R. Andorno, *op. cit.*, pp. 1-27.
[53] M.J. Farah, *Neuroethics: An introduction with readings*, MIT Press, Cambridge, 2010.

humanities have failed[54]. Neurosciences promise to address social problems by direct and modified interventions[55].

However, they remain incapable of (or unwilling to) offering a shared social model to which one can strive to establish the parameters of what constitutes normal and pathological behavior. They typically only address an imprecise undesirability, which, still, allows room for dubious, if not dangerous, arbitrary remedies. Neuroscientists, as we demonstrated, should come out of the labs and take part in the discussions about the direction of society (and law), offering an ostensibly "neutral" viewpoint while striving for a significant shift. Radical neuro-enthusiasts claim that this transition will be traumatic, whereas neuro-tepid-reformists claim that it will be gradual and less intrusive. As per the latter, advances in neuroscience and technology will merely lead to a gradual enhancement of civilization.

Under these new circumstances, neurolaw will remain a controlled method, reduced to a tool for societal growth, according to scientific criteria rather than moral principles. As a result, the condition of infirmity is linked to social dangerousness and is conceptually equivalent to "mental disorder" actions that are signs of neuronal brutality and cannot be tolerated in a society founded on neuroscience[56].

Thus, the question is not whether neuro-civilization is good or bad, but rather which domains it would invade without proper regard for individual liberty, or where neuro-deviance would have to be eradicated by forceful brain intervention. We must acknowledge the significant role played by the deviant figure. Additionally, it stands for the opposition to social order that is critical and compels society to examine itself. Undoubtedly, this was the assignment given to the most well-known outcast, Socrates. Finding a place for this actor is, in our opinion, imperative, even in a society founded on neuroscientific principles.

We showed, in conclusion, the critical role that cognitive liberty plays in this new neuro-centric society. We started by outlining the significance and characteristics of the idea of cognitive liberty, which is seen as the foundation for all other rights because it is their neuro-cognitive system.

Secondly, we discussed the suggestions made by various advocates of cognitive liberty, who see it as both a basic human right and a key legal precept that directs the regulation of neurotechnologies. As Bublitz noted, it is "hard to conceive of any conception of a legal subject in which the mind and mental capacities (e.g. Acting from reasons, deliberation) are not among its necessary constitutive conditions". This is something to keep in mind in this regard[57].

[54] About brainwashing, see W. Bowart, *Operation Mind Control*, Collins Sons & Co., Glasgow, 1978.
[55] K. Taylor, *Brainwashing. The science of thought control*, Oxford University Press, Oxford, 2004.
[56] S.J. Morse, "The status of neurolaw: A plea for current modesty and future cautious optimism", in *The Journal of Psychiatry & Law*, 39 (2011), n. 4, pp. 595-626.
[57] J. Bublitz, "My mind is Mine!? Cognitive Liberty as a Legal Concept", in E. Hildt, A. Francke (eds.), *Cognitive Enhancement*, Springer, Dordrecht, 2013, pp. 233-264.

Subsequently, as a third step, we argued how Cognitive Liberty has all the features it needs to make it a key concept from which new human rights can emerge. It cannot be boiled down to only the rights that already exist, for this reason. It could, however, be viewed as the foundation for all liberty, both internal and exterior. Cognitive liberty aligns with the definition of human rights, which states that all people have the inalienable right to certain freedoms "just because they are Human"[58] irrespective of their nationality, place of residence, language, religion, ethnic origin, or any other status. This is because all people possess cognitive life, in it in varying degrees and forms.

As a fourth Step, we demonstrated how the protection of human characteristics that are not fully covered by current rights will be made possible by the inclusion of cognitive liberty within this framework of human rights. Then, we discussed how data confidentiality and integrity are guaranteed by Blockchain technology, which enhances the way neuroscientific evidence is processed legally. Technology has the power to improve the reliability and equity of legal processes; yet, it requires the resolution of technological challenges and the development of digital literacy among attorneys.

Finally, we discussed how blockchain technology in neuro-law promotes cognitive liberty by facilitating ethical data exchange and safe consent management. Blockchain technology ensures data confidentiality and integrity, which improves the legal processing of neuroscientific evidence. The incorporation of technology holds the potential to enhance the dependability and equity of legal procedures; yet, it necessitates the resolution of technological obstacles and the promotion of digital literacy among legal practitioners. This encourages confidence and accountability in the use of neurotechnologies, making interdisciplinary cooperation necessary for responsible development and implementation.

In this essay, we suggested viewing these actions as rungs on a figurative staircase leading to the national and worldwide defense of each person's inner world. In this way, Cognitive Liberty might serve as a foundational idea for a novel form of "habeas corpus", a legal avenue via which an individual might denounce unauthorized legal access to their inner life.

This new "habeas means" would imply that "my mind is free" – that is, unrestricted by outside influences and able to evolve whenever we see fit[59]. In conclusion, we request approval for the legal acknowledgment of neuro-cognitive problems in a proactive and defensive manner, as well as the incorporation of blockchain technology for data security. What shape these neuro-rights take is not important to me. Discovering this issue and placing Cognitive Liberty at the center

[58] M. Sepuldeva, T. Van Banning, W.J.M. Van Genugten, *Human rights reference handbook*, University for Peace, Ciudad Colon, 2004.

[59] See P. Sommaggio, "La tutela della integrità mentale tra proprietà, beni comuni e libertà cognitiva", in *Sociologia del diritto*, (2022), n. 1, pp. 98-128.

of this conceptual turning point for our global society of the future are things that intrigue us.