COGITO ERGO NON SUM: FREEDOM OF THOUGHT AND NEURAL DEVICES

COGITO ERGO NON SUM: LIBERDADE DE PENSAMENTO E DISPOSITIVOS NEURAIS

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Abstract: This work analyzes the threats neurotechnologies can pose to protecting freedom of thought as a fundamental right and a right of psychic and intellectual integrity. Neurotechnologies have made it possible to advance knowledge about brain information, and continuous technological advances have led to a better quality of life for people with neurological diseases. This field of expertise and innovation has produced new treatments for various disorders. This revolution, however, implies a brain-machine relationship that allows access to profoundly private information since the brain is the last frontier of privacy. In this sense, this article reflects on the risks that implanted neural devices and invasive neurotechnologies may pose to fundamental human rights. It concludes that creating a new category of neurological rights, enshrined in the Federal Constitution, is essential to face the coming scenario.

Keywords: Freedom of thought. Neurotechnology. Neurorights. Fundamental Rights.

Resumo: Esse trabalho tem como objetivo analisar as ameaças que as neurotecnologias podem representar para a proteção da liberdade de pensamento como um direito fundamental e como um direito de integridade psíquica e intelectual. As neurotecnologias permitiram que avançassem no conhecimento sobre informações cerebrais e os avanços tecnológicos contínuos têm gerado maior qualidade de vida para pessoas que convivem com doenças neurológicas. Esse campo do conhecimento e da inovação permitiu a produção de novos tratamentos para diversas doenças. Essa revolução, no entanto, implica em uma relação cérebro-máquina que permite acessar informações profundamente privadas, posto que o cérebro é a última fronteira da privacidade. Nesse sentido, esse artigo reflete acerca dos riscos que os dispositivos neurais implantados, e as neurotecnologias invasivas, podem representar para os direitos humanos fundamentais.

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Conclui-se que a criação de uma nova categoria de direitos neurológicos, positivados na Constituição Federal, é imprescindível para enfrentar o cenário vindouro.

Palavras-chave: Liberdade de Pensamento. Neurotecnologia. Neurodireitos. Direitos Fundamentais.

1 Introduction

The myth of Prometheus from Greek mythology is an interesting symbolic contribution to introduce the problematics of this work. Prometheus is known for his artisanal skills and deep relationship with knowledge. He taught men various skills, such as methods to cure diseases, types of metals for toolmaking, and the ability to create languages. His philanthropy defied the punishments Zeus inflicted to punish humanity. One such punishment was the deprivation of fire, intended to make humans foolish. This punishment was, in fact, a result of Prometheus having previously tricked Zeus. Prometheus divided an ox into two massive parts, one containing the meat and the other only bones. Zeus had to choose one, and the other would be offered to men. Zeus chose the latter, and his wrath and hatred motivated him to deprive humanity of fire, leaving them symbolically naked. Indignant with Zeus's punishments to humanity, Prometheus stole fire to give to humans, pouring Zeus's wrath upon them once again (Hesiod, 2012).

Humanity then gained a severe advantage, with the power to nearly dominate the world. Zeus, from atop Olympus, observed Prometheus's betrayal with profound scorn. He saw in humanity a potential threat to the gods. Even fragile, they could be highly audacious. Through the sacred fire, humanity could shape the world and alter life. Even in the cruelest winter, they could warmly cover the world, manipulate tools, and excavate riches. However, a plague from Zeus devastated Prometheus's work: he watched humanity burn cities and crops and saw men use the tools he showed them to kill and enslave others. Eventually, Prometheus himself became the target of Zeus's revenge. He was imprisoned atop Mount Caucasus by Hephaestus, the god of metallurgy. Every day, an eagle would come to eat at Prometheus's liver. The creature devoured his liver for hours, regenerating it at night so the bird would return to consume it again the next day. He suffered this fate for many generations until he was freed by Heracles (Hesiod, 2012).

The myth of Prometheus, featured in "Prometheus Bound" by the Greek playwright Aeschylus, has several fundamental symbolic points. Fire is a practical representation of humanity's material advancement, a milestone of human evolution and creative capacity, and a symbolic element, signifying the rise of knowledge and the broad possibility of transforming nature. With humanity's faculty to transform comes profound consequences and contradictions. The gift of fire allowed humanity to advance produce, culture, technology, transit, and civilization, but it also brought abuses.

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Drawing inspiration from the myth of Prometheus to the present reality, it can be thought that technology, while potent, can cause significant harm. In the context of rapidly producing disruptive technologies, humanity faces dilemmas similar to those brought by the sacred fire in the tale. There is a need to deal with a technological horizon that, without proper regulation, has the power to devastate. This work uses the initial presentation of a Greek myth to address the crossroads of technology in current and futuristic terms. It deals with neural devices and their threats to mental integrity and privacy. It questions to what extent these devices, if poorly managed and regulated, can consume fundamental freedoms in a dynamic superior to that described by many authors, who reveal the extractive nature of the current data economy.

Neural devices, or neurotechnologies, are instruments and procedures used to access, analyze, map, investigate, evaluate, manipulate, and emulate the structure and functions of people's neural systems. They are capable of both recording brain signals and translating them, as well as producing commands to manipulate brain activity through electrical or optical stimuli. There are at least three central types of devices in neurotechnology (Australian Human Rights Commission, 2023). Those that monitor brain activity, such as an electroencephalogram; devices that intervene in brain activity, like a brain pacemaker; and devices that combine both functions, like the proposal of Neuralink, a brain chip developed by Elon Musk's[1] company, which aims, in theory, to help people with paralysis control devices with their thoughts.

On the positive side, scientists have been developing implantable and non-implantable therapies for mental and neurological diseases for years, significantly improving the quality of life for people with Alzheimer's, depression, schizophrenia, and other conditions. On the other hand, brain-computer interfaces, or BCIs, are bidirectional communication channels of brain data. These are intimate data about cognition, intentions, and an individual's health or illness. Profound ethical and legal dilemmas are involved in connecting a patient's brain to equipment. Whether invasive or non-invasive, legal gaps raise critical aspects of human rights protection in this scenario (Falqueiro, 2021).

The strides in neurotechnology and artificial intelligence have opened innovative avenues for accessing the information on animals' and humans' behavior and brain functions. There is a concerted global scientific effort to understand the human brain with sophisticated technologies, among which neural networks have emerged as a significant focus of technological investment. The industry has been propelling the research and development of neurotechnologies that could herald a new epoch in neuroscience, impacting various fields significantly (Falqueiro, 2021).

Biotechnological advancements have facilitated a profound leap in knowledge over the past decades, encompassing an in-depth understanding of the brain and neural functioning. Contemporary neuroscience has enabled scientists to conceptualize new perspectives on human

1 SCHWALLER, Fred. *Neuralink:* What can Elon Musk's company's brain microchips do? (Neuralink: o que podem fazer os chips cerebrais da empresa de Elon Musk?). Published on Sept. 20th, 2023. Available at: https://g1.globo.com/inovacao/noticia/2023/09/20/neuralink-o-que-podem-fazer-os-chips-cerebrais-da-empresa-de-elon-musk.ghtml. Accessed on Nov. 24th, 2023.

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consciousness and its external manipulation. Although seemingly distant, this knowledge and the relentless advancement of technology could help not just an understanding of brain activity but also the superficial formulation of behavioral patterns through brain-machine interfaces, as well as the public disclosure of profoundly private information, for the brain represents the final frontier of privacy yet untouched by the information economy (Madrid; San Martin, 2021).

This topic is of urgent and significant concern for the field of law. The distinction between natural, digital, or virtual is blurred, and disruptive technologies are advancing rapidly. What is currently a futuristic dilemma could soon become a phenomenon of profound violation of personality rights. An Australian neurosurgeon, Tom Oxley, explains that the brain is a bastion of privacy, a person's last private part[2]. The potential of neuroscience and neurotechnology is boundless, especially considering the pace of their advancements. However, the level of intrusion necessary to realize the benefits of neuroscience in people's lives poses a significant problem.

This article analyzes the threats neural devices pose to protect freedom of thought and personality rights. Its specific objectives include outlining the current legal treatment of freedom protection in Brazilian law, theoretically analyzing the risks of neural devices, and reviewing the category of neuro rights and their potential to mitigate effects. This is accomplished through a hypothetical-deductive research approach and a literature review to understand how doctrinal and theoretical interpretations have evaluated the issue. The work is divided into three sections.

The first section briefly notes the concept of freedom of thought in the Brazilian legal order as part of personality rights. The second section discusses current mechanisms of human behavioral manipulation and the loss of individuality in decision-making processes due to these technologies. It also addresses neural devices and the issues involved in their use from the perspective of human and personality rights protection, especially the validity of neuro rights as a fundamental right. This section aims to present an overview of the behavioral manipulation that current technologies already exhibit and the potential exacerbation of these characteristics with implantable devices in the coming decades. The third and final section points to regulating this protection as an aspect of the existence of neuro rights, safeguarding freedom of thought from the outset.

2 Freedom of thought in the Brazilian legal system

Freedom is the power of individual action, the absence of prohibitions. It represents the possibility of acting without interference from the State or others as long as it aligns with what the legal system and order permits. It is a complex right, considered in its various ramifications, both as a fundamental and a personality right (Amaral, 2008). The Declaration of the Rights of

2 WILD, Kate. *'Our notion of privacy will be useless':* what happens if technology learns to read our minds? (Nossa noção de privacidade será inútil: o que acontece se a tecnologia aprender a ler nossas mentes.) Published on Nov. 6th, 2021. Available at: https://www.theguardian.com/technology/2021/nov/07/our-notion-of-privacy-will-be-useless-what-happens-if-technology-learns-to-read-our-minds. Accessed on Nov. 24th, 2023.

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Man and the Citizen, 1789, already defined freedom in terms of exercising natural rights and the limits to be proposed through legislative intervention to establish it. In this declaration's conceptualization, freedom is the ability to do everything that does not harm others.

As a natural right of the person, the only limits delineating it are the boundaries with others and the State, primarily to ensure the same rights for other members of society. This definition encompasses two principles: the supremacy of law and legal reserve. Regarding freedom of thought and expression, the document stipulates in Article 10 that the only restriction to this freedom is maintaining public order, as established by law. In other words, the scope of freedom protection can be legally restricted to preserve public order. Independence of thought appeared more as an element of freedom of expression, mainly since expression was the only means of accessing thought (Ferreira Filho, 2012).

Freedom of thought is a defensive right, imposing a duty of non-interference on the State, as it forms part of the constitution of an individual's self-determination. These rights prevent the State from intervening in certain goods. The legally protected good in the context of freedom of thought is freedom itself, as the individual has the prerogative to develop autonomously in the social world. The guarantee of the integrity of one's reflections and thoughts is part of protecting the human person. Freedom of thought is enshrined in the Federal Constitution 1988 as a fundamental right. Article 5, Clause IV asserts that the expression of thought is free, with a prohibition on anonymity. It appears in another article of the Magna Carta, emphasizing the freedom of thought, creation, expression, and information in any form, observing the limits in the face of other rights (Moraes, 2012).

Freedom is not an absolute right. Once it assumes the features of the freedom of expression of thought, manifested in opinions and convictions on a subject, the legal limits that restrict unrestricted freedom must be considered. Freedom of thought is divided into two facets, and it is essential to position them to understand the theme of neuro rights. The first facet is the freedom of conscience, and the second is the manifestation of thought. The former is an inner freedom. Its existence is unrestricted. It can be conditioned through external stimuli, such as current behavioral manipulation techniques, but, in principle, it is free, as no one can be forced to think in a specific way. This is the freedom provided for in Article 5, Clause VI of the Constitution, which is inviolable. It is essential to consider thought as a capacity linked to intimacy, more restricted than privacy itself, as it pertains to the deepest layer of a person's personality. In thoughts, freedom is unrestricted; it is impossible to punish thinking until it becomes explicitly externalized through opinion (Ferreira Filho, 2012).

The second facet is precisely when the freedom of conscience becomes extroverted. Individuals act in specific ways according to their beliefs, ideologies, and convictions and tend to expose their thoughts to others as part of the dynamics in society. It is the manifestation of thought, enshrined in freedom of expression, which is protected but also limited by its capacity to preserve the individual's personality and harm others. Individuals may act according to their

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conscience and belief; the Magna Carta guarantees this freedom but not in an absolute manner (Ferreira Filho, 2012).

Freedom of thought is fundamentally a defensive right, imposing upon the State a duty of non-interference as it is intrinsic to the constitution of an individual's self-determination. These rights serve to prevent State intervention in specific domains. The legally protected good within the scope of freedom of thought is freedom, as it allows the individual to develop autonomously within the social world. Ensuring the integrity of one's reflections and thoughts forms a part of the overarching protection of the human person. In the Brazilian Federal Constitution of 1988, freedom of thought is enshrined as a fundamental right, specifically in Article 5, Clause IV, which asserts that the expression of thought is free, barring anonymity. Another article of the Constitution highlights the freedom of thought, creation, expression, and information in any form, subject to limitations about other rights (Moraes, 2012).

Freedom is not an absolute right. As it takes on the features of freedom of expression of thought, manifested in opinions and convictions, it becomes necessary to consider the legal limits that confine unrestricted freedom. Freedom of thought is bifurcated into two facets, essential for understanding the concept of neuro rights. The first facet is the freedom of conscience, and the second is the manifestation of thought. The former represents an inner freedom. Its existence is unrestricted, subject to external stimuli such as current behavioral manipulation techniques, but in principle, it is free, as no one can be compelled to think in a specific manner. This is the inviolable freedom stipulated in Article 5, Clause VI of the Constitution. It is crucial to recognize that it is regarded as a capability tied to intimacy, more restricted than privacy itself, for it pertains to the deepest layer of a person's personality. In thoughts, freedom is indeed unrestricted; it is impossible to punish thought until it is made explicitly externalized through opinion (Ferreira Filho, 2012).

The second facet is the moment when the freedom of conscience becomes externalized. Individuals act in specific ways according to their beliefs, ideologies, and convictions and tend to express their thoughts to others as part of the dynamics in society. This is the manifestation of thought, enshrined in freedom of expression, which is protected but also limited by its ability to preserve the individual's personality and potentially harm others. Individuals may act according to their conscience and belief; the Constitution guarantees this freedom, but not in an absolute manner (Ferreira Filho, 2012).

With freedom of thought, people control how much and what they choose to externalize—at this juncture, the transition from being a restricted product of personality to an externalized product. However, it still expresses the individual's intimate understanding and beliefs. The State ensures the manifestation of freedom in two ways: positively, with guarantees for the externalization of opinion, and negatively, with the prohibition of censorship. The expression of thought is free, and prior censorship of public expression is not permissible.

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However, abuses committed through its unrestrained expression, potentially violating the rights of other individuals or the community, are subject to civil and penal responsibility.

These constitutional features conclude that freedom of thought is a derivative of thought as a free right, currently unbound by any restriction. It is not permissible to prohibit individuals from thinking, even the most absurd thoughts. Thought represents the deepest layer of human privacy. What is constitutionally regulated and codified is the expression of thought, symbolizing the autonomy of individuals and their capacity for social relations and also delineating the boundaries so as not to materially or morally infringe upon others' right to opinion, reflection, and existence (Ferreira Filho, 2012).

The right to freedom of thought also integrates into the category of personality rights as part of psychic rights. It is distinguished as a right encompassing different manifestations in line with the activities an individual undertakes in all aspects of life, be it personal, occupational, spiritual, and the like. The Brazilian legal system provides various interpretations of the right to freedom as a core content of human personality, encompassing mobility, expression, communication, and thought. Regarding the subject of this article, it is pertinent to interpret that this right allows an individual to protect and maintain their psychic faculties in intersubjective relationships according to their own will (Bittar, 2015).

This may mean autonomously sharing one's thoughts, keeping them private, partially revealing ideas, or never sharing them. Recognizing this right enables holders to protest against violating their human faculties. Only the external actions of a person are protected; hence, thought itself is an inalienable right, though less covered in doctrine, as the expression of thought is more frequently asserted, even given the secretive nature of the thinking faculty. Nevertheless, as a right that is part of the category of personality rights, it is presented as indivisible (Bittar, 2015).

However, this right does not have explicit provisions in the Civil Code. Brazilian law covers only five personality rights: the right to the body, name, honor, image, and privacy. Indeed, the concept of privacy can be invoked when considering freedom of thought, especially in the discussion of neuro rights. This does not imply that there is no protection in the legal system, thanks to the general clause of the safety of human dignity. Freedom of thought is part of the right to psychic and intellectual integrity. Although the Civil Code lacks this direct safeguard of these rights, they are applied by force of the Constitution.

Nevertheless, the absence of explicit recognition engenders many doctrinal and jurisprudential debates. Without clearly recognizing the norm, it becomes necessary to ascertain to what extent the depicted sphere constitutes the essence of human personality. There is sometimes consensus on this, but the constitutional provision covers the controversy, specifically regarding freedom of thought (Schreiber, 2013).

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3 Dystopias of reality: invasive technologies and the loss of individuality in the face of neural devices

Alternatively, it is possible to reflect on the integration of the right to freedom of thought as part of the right to the body in terms of the discussion brought forth by Rodotà (2004) on the transformations of the body in the face of technology. The body has become an instrument through which the State and organizations intensify security measures and tighten control mechanisms. In his perspective, posited nine years ago, he considered that the mind would soon be captured due to the invasions of control technologies in everyday life. Not even the most intimate sphere of the human body escapes these invasions.

Various mechanisms across different domains have begun to utilize computerized analyses of human behavior, turning the body into a continuous data mining object, an open pit mine from which data can be incessantly extracted. Rodotà (2004) references biometric data in his analysis, but the currently unfolding scenario might be much more profound. Considering physical data, as he demonstrates, is not a dissociation between body and technology but a fusion of the two. This leads to a decomposition of the body in the face of information collection, reducing the identity of subjects.

Rafael Yuste, a Spanish neuroscientist renowned for advocating ethical limitations for the use of technologies, emphasizes[3] that this is the moment for humanity to decide on the technological path it wishes to pursue. He is aware of the power his field can reach, not only in knowledge but also in manipulating the human brain. Hence, he argues that governments should pay attention to the potential violations posed by neurotechnologies and create a specific category of rights to regulate this issue. Until a few years ago, the dystopian scenario discussed in this work could have been a mere science fiction film. However, companies known for globally dominating the technology sector, such as Meta (formerly Facebook), Microsoft, and Neuralink (owned by Elon Musk), have invested in firms working on scientific research and brain-computer interaction. In Musk's case, his company has initiated an artificial intelligence project to develop implantable chips.

There has been a concern about the protection of brain data introduced previously. In 1999, the Center for Cognitive Liberty & Ethics was established to protect individuals' freedom of thought in the face of rising neurotechnologies. This challenge was already significant nearly two and a half decades ago. However, what brings back the discussion of freedom of thought and its relevance and urgency for regulation is the emergence of neurocapitalism. Indeed, there are companies with noble intentions, producing serious science to help, for instance, paralytic patients easily control brain-computer interface equipment.

3 SALAS, Javier. *Why it is necessary to prohibit the manipulation of our brain before it becomes possible.* (Por que é preciso proibir que manipulem nosso cérebro antes que isso seja possível.) Published on Feb. 13th, 2020. Available at: https://brasil.elpais.com/ciencia/2020-02-13/por-que-e-preciso-proibir-que-manipulem-nosso-cerebro-antes-que-isso-seja-possivel.html. Accessed on Nov. 24th, 2023.

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Nevertheless, it is essential to discuss the topic through an Orwellian lens and question what will become of human privacy if brain data are used to manipulate behavior and personality. The brain is the intimate escape. The thought that this small box might be on the verge of being scrutinized and mapped has motivated many theorists, jurists, and activists to advocate for creating a new category of rights (Frazão, 2019).

Yuste et al. (2017) have developed a document outlining ethical priorities that should be respected in creating brain-computer interfaces to preserve individuals' privacy, autonomy, identity, and equality. Initially, they present a hypothetical scenario. They ask one to imagine a paralytic man participating in a clinical trial of a brain-computer interface. A computer connected to his brain can interpret desired neural activities from his mental rehearsals. This computer generates commands from these mental rehearsals and moves a robotic arm. One day during the experiment, the man becomes frustrated with the study team. His mechanical hand crushes a glass and injures an assistant. He apologizes and explains that the device was malfunctioning but wonders if his frustration influenced the mental rehearsals that led him to crush the glass and hurt the assistant. Although hypothetical, this is one of the challenges societies may soon face.

Even though these technologies have not yet become part of everyday reality, technological development has shown that the path being charted is towards a world where individuals' mental processes could be interpreted through studies of neural activity, potentially linking to mechanisms of cognitive and behavioral manipulation. It is crucial to consider these possible ramifications, as the abusive use of technologies has already demonstrated significant potential for human rights violations and exacerbation of inequalities. It is emphasized that they can alter the experience of people with neurological diseases. Still, a serious discussion is needed on how these tools can exploit and undermine freedom of thought because, once it is possible to interpret what an individual thinks and how they react to a specific phrase or scenario, it becomes possible to alter the person's autonomy. Mental life was, until recently, completely private. A different social reality is already conceivable (Yusef et al., 2017).

Therefore, Yusef et al. (2017) point out four central concerns that must be observed to regulate the uses of neurotechnologies. In a broad use of neurotechnologies in the consumer market, they suggest that devices should be non-invasive, low-risk, and offer more significant cost-benefit. Even in the current scenario, where companies are beginning to formulate the architecture of these devices, they must be guided by privacy standards and ethical practices. Non-invasive devices like helmets, glasses, and bracelets remain external to the brain, typically worn on the individual's head. They still dominate the consumer neurotechnology market. Implantable devices are invasive, placed inside the brain with electrodes that send brain data to a machine (Australian Human Rights Commission, 2023).

Sigal Samuel has been one of the key figures in the public discussion following the advances in neuroscience and their interfaces with artificial intelligence. After producing various articles on the development of brain invasion technologies and the relationship that major

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technology players have built with this area, the journalist eventually reported[4] the creation of a technique developed by scientists at the University of Texas at Austin to translate brain activity into actual speech.

Research conducted by Moses et al. (2019) previously demonstrated that brain-computer interfaces could decode speech articulations and other signals through intracranial recordings, aiming to restore communication for people who cannot speak. The decoders required overly invasive surgeries, often making their use impractical. Decoding was done by implanting electrodes in the individual's brain and finally using an algorithm to read the individual's brain activity and translate it into text on a screen. They presented the possibility of using non-invasive techniques. Still, they only recorded essential signals or short phrases, lacking the necessary accuracy in the output, offering only a set of possibilities.

The novelty is that researchers have created a non-invasive brain-computer interface that can decode brain language, allowing others to access the essence of what is thought, even if the individual does not utter a single word. One of the tasks of these interfaces is precisely to decode imagined speech in the absence of external stimuli. Scientists use magnetic resonance imaging combined with artificial intelligence language models for this innovative technology. The "training" of the technology occurred with the participation of collaborators who listened to podcasts. At the same time, scientists used a magnetic resonance imaging machine to understand the difference in blood flow in their brains when they heard specific phrases. Using artificial intelligence models, they tracked each person's brain appearance in response to particular phrases and expressions. The decoder, which uses a GPT language model, can decode the essence of imagined speech, even if it does not accurately reproduce the words verbatim (Tang et al., 2023).

The first area of concern is privacy and consent. Much information can be obtained from the analysis of motor and neural behavior. Research has indicated that a refined analysis of motor behavior, focusing on typing patterns on keyboards, can indicate an early diagnosis of Parkinson's disease. Other studies have shown that mobility patterns recorded on mobile devices during normal activities can diagnose early symptoms of Alzheimer's disease. Billionaire investors have been betting on financial products in neurotechnology and artificial intelligence, not coincidentally. If it is possible to identify neural patterns through simple motor and mobility applications, the potential relationship between neurotechnology and advertising must be especially considered. Regarding privacy, internet-connected neural devices can facilitate behavioral manipulation of individuals by various organizations. The default determination should always be for maintaining freedom of thought, and non-sharing should be the protected choice (Yusef et al., 2017).

Even with an approach that includes the possibility of excluding neural data or obtaining explicit consent for its sharing, neural data shared by voluntary sharers—intended primarily

4 SAMUEL, Sigal. *Mind-reading technology has arrived.* (A tecnologia de leitura da mente chegou.) Published on May 4th, 2023. Available at: https://www.vox.com/future-perfect/2023/5/4/23708162/neurotechnology-mind-reading-brain-neuralink-brain-computer-interface. Accessed on Nov. 22th, 2023.

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to aid in treating diseases—can be combined with a plethora of non-neural data from other internet applications. This amalgamation could conclude individuals who opted not to share simply by reading behavioral patterns. Using neural data must be strongly regulated, with strict and firm standards (Yusef et al., 2017).

Many companies use a specific machine learning technique to train a shared model interactively. It works as follows: a company employs automated learning to improve its software. They collect information from individuals' routes in their application to analyze how a particular service is experienced. From this, they use the insights to train new algorithms with the aggregated user experience data. The alternative model is called federated learning, and the learning model generates new data from the user's experience on their device without centralizing the data. Thus, the lessons aggregated from the user experience are not collected and stored on the central servers of the technology company. This approach represents a form of differential privacy, which should be applied in neurotechnology, including smart contracts[5] that provide transparent data controls without a centralized authority (Yusef et al., 2017).

The second sphere of concern is the agency and identity of individuals in the face of neural devices. People who receive invasive brain stimulation through implantable interfaces report feeling a different sense of identity. This is problematic because neurotechnologies can disrupt people's decision-making capacity, agency, and identity, potentially threatening fundamental and personality rights. Identity is a profound constitution of self-perception, internally and concerning the world. These interferences have legal and moral consequences. In a hypothetical scenario, if it becomes possible to control devices with thought from great distances or if multiple brains can collaborate in a programmed manner, it may be challenging to understand the subjective limits of the self and act in disturbing ways (Yusef et al., 2017).

The research by Klaming and Haselager (2010) lists severe complications from the use of implantable devices, including cognitive and psychiatric symptoms such as decline in word fluency, deterioration of verbal memory, depression, emotional dysregulation, and others. Treatment with implantable devices has many exciting uses for disease treatment, and patient responses regarding the specific disease are usually positive. However, a modification of the sense of identity in patients has been observed, presenting dissociative responses and identity state alterations, significantly when the stimulus from the devices is increased.

Another intriguing research by Bublitz and Gilberto (2023) discusses the case of a patient who volunteered to receive an implantable brain-computer interface. This device was designed to monitor neural signals, not stimulate the brain. The BCI, implanted by NeuroVista, could predict epileptic seizures. The patient in question, referred to as "Patient R," had suffered from chronic epilepsy for over 40 years. His quality of life significantly improved with the device's implantation. However, he experienced a severe alteration in his sense of identity, feeling

5 To see a more detailed approach to smart contracts, consult: UHDRE, Dayana de Carvalho. *Blockchain, tokens and cryptocurrencies: legal analysis.* (Blockchain, tokens e criptomoedas: análise jurídica.) São Paulo: Almedina, 2021.

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a symbiosis with the device. He declared that he had "become one" with the apparatus and described an altered capacity for confidence, feeling like he could do anything. The company went bankrupt during the patient's treatment period, and although they opposed the removal of the device, they were obliged to extract it. Following this period, the patient exhibited substantial psychological damage, living with the sensation that the device completed him. The instrument became part of the patient's self-conception, an aspect of his personality. Discussing the psychological consequences and alterations in the integrity of freedom of thought in cases like this is crucial.

In this context, the reflection on agency and identity re-emerges as fundamental ethical dilemmas in neurotechnologies. Individual identity, including intellectual integrity and freedom of thought, should be protected as a fundamental right and the dimension of agency—the capacity to choose actions and make sober decisions. It must be adequately explained, including through international declarations—with countries' adherence—about the cognitive and emotional effects of neurotechnologies. Current forms generally only deal with consent regarding the physical risks of implantation surgeries. In some cases, strict restrictions should be summarily recommended. A new category of rights within international Human Rights treaties should be considered, as well as conventions to define prohibitions related to the intersection of neurotechnologies and artificial intelligence (Yusef et al., 2017).

The third area of concern relates to the social stigma suffered by people with different brain or body functions, influencing social pressure to adopt technologies that allow them to simulate "normality" within the stigmatized concept of what is expected in society. Technologies promising to enhance endurance or mental capacities can help, but they can also create new forms of discrimination if deemed obligatory for perceived normality. In a dystopian scenario, alterations in mental capacities might influence military sectors, for example, under the super-heroic notion of "super-intelligent agents." This work has demonstrated researchers' advancements in stimulating the brain for complex connections, and the discussion of enhancing the mental capacity of soldiers has already been debated in the arms race. What is expected is the production of general, international regulation that establishes guidelines for uses, but with due limitations to spheres that might harm human rights (Yusef et al., 2017).

Although an international legal good, privacy has specific cultural contours, observing universal rights and guidelines of international law. Individuality is more valued in some cultures than others, which can significantly alter a legal system's reflection on adopting these parameters. Therefore, it is essential to construct an international dialogue to evaluate how a new category of rights can be incorporated into international protocols. This depends on collective, multi-sectorial efforts. Instead of creating a protection scenario, the total prohibition of these technologies might lead them into clandestinity. Hence, joint efforts are indicated to establish specific laws and regulations after profound debates about the current state of technology and foreseen risks (Yusef et al., 2017).

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Finally, biases inherent in technological decisions must be considered. Due to systemic inequalities, there are sets of concepts and norms that may privilege certain groups. Like other technologies presenting deep-seated issues of inequality, those formulating neurotechnologies must build mechanisms to prevent various prejudices from being implicated in the conception of technological development. There is an urgent need for the construction of responsible neuroengineering, aware of the issues highlighted by Yusef et al. (2017), especially since it enables the development of innovative structures that anticipate and engage in structural changes. Innovation must accompany a responsible ethical and legal framework, as complex ethical dilemmas have emerged in technology throughout history but are often lost to the economic benefits of unchecked use of innovation. However, this results in a loss in the realm of human rights.

While believing in the dystopian scenarios described in this section may be difficult, this is not an Orwellian novel. This type of technology has advanced and has already changed people's lives. The most common uses are brain implants that allow paralyzed people to control robotic arms through their thoughts. Non-invasive interfaces, still in the testing and scientific verification phase, have progressed in processing neural language. They are far from commercial availability but are moving towards an ethically and legally problematic scenario. To illustrate the potential for violation, it is essential to present the state of current behavioral technologies and a possible intensification of these techniques due to neurotechnology.

One mechanism demonstrating the possibility of violations of fundamental and personality rights, including freedom of thought, is the technique known as *profiling* or personalization. As a concept, *profiling* is a procedural technique for supposing and extrapolating information about a person based on their known traits and tendencies from various pieces of information. It involves constructing a user profile based on data analysis, allowing for inferences and action recommendations. *Profiling* builds stereotypes and tests people's reactions to inferred behavioral patterns; from there, it undertakes a continuous process of experimentation, diagnosis, analysis, and refinement to garner more responses (Zanatta, 2019).

Profiling and *Cluster Profiling* are familiar knowledge, and pattern recognition is a common task in advertising. What has changed in the information economy is the exponential growth of data and easily processable traces. All these data constitute the raw material from which organizations analyze, map, indicate, and manipulate individuals' behavior concerning goods and services. This operation is based on the convergence of diverse services and applications, including the connection between the web, mobile devices, financial systems, biometric identification systems, geolocation data, artificial intelligence, and a host of applications that participate in the automatic generation of data, creating profiles and shaping individuals' behavior in the face of this powerful force of data extraction and experimentation (Gutwirth; Hildebrandt, 2010).

Zuboff (2021) calls this phenomenon "behavioral surplus," where data is continuously collected, even those that may be considered useless but become gold mines when combined

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with other information. All sectors are connected, and significant technology organizations interact to create an intense atmosphere of analysis and prediction of people's digital behavior, delivering specific results. The change is the level of accuracy this mechanism possesses, as it can provide a particular message to a specific person at the exact moment when their behavior for a particular good or service can be influenced. It is a profound "mind reading" process through the traces left in people's online behavior. It's as if these organizations know precisely what a person thinks, feels, and wants at a specific time and place because they can predict their interests based on previously acquired information.

Suppose this is the depth of behavioral manipulation in current technologies. In that case, one must reflect on to what extent it is possible to go with brain-computer interfaces that can collect individuals' neural information and stimulate their behavior through intracerebral devices.

4 Towards strong regulation for the protection of freedom of thought and neuro rights

Information law must be revised to protect neural information, as neurotechnologies create unprecedented threats to freedom of thought. Indeed, legal goods are implicitly protected even within the neuroscientific discussion through the idea of neuro data and neuro privacy, which deals with protecting the privacy of citizens' neural information. Neurodata is a category that responds to all information representing brain functioning, i.e., any information concerning someone, even if collected with their consent, that can identify them. Both dimensions constitute neuro rights but should not be thought of in traditional terms of data and privacy discussion (Madrid; San Martin, 2021).

This particular category of information requires new legal institutes to address it in a specialized manner. Current legal categories have limits because legal theories explain different human phenomena. Previously, it was unthinkable that technologies would reach the state of collecting neural information through implantable devices. This poses unimaginable ethical and legal challenges. For example, the Brazilian legal system guarantees freedom of thought in conjunction with freedom of expression, which is the active form that thought and reflection present. However, to think about freedom of thought in the era of neurotechnology is to protect the object itself, the very considered, since it no longer needs to be expressed through voice to be collected (Madrid; San Martin, 2021).

The freedom of thought and conscience has consistent philosophical presuppositions, as human cognitive freedom is omnipresent in the history of ideas. Since the 3rd century BC, freedom of conscience has been philosophically discussed, even though this object has been interpreted differently throughout history. In modernity, Woolf revived mental freedom by asserting that no lock could be placed on the human mind. This debate, treating the mind as the

last locus of personal liberty, has been the tone for discussing the regulation of neurotechnologies and the creation of the category of neuro rights. Freedom of thought is defended by a theoretical, philosophical, and legal tradition that considers the protection of conscience as a necessary safeguard for exercising all other rights (Ienca, 2021).

In a normative sense, it is protected by the Universal Declaration of Human Rights, which legally binds all member states of the International Covenant on Civil and Political Rights. The international declaration brings freedom of thought, conscience, and religion together, but the right to freedom of thought is broad and encompasses various themes (Ienca, 2021). In Brazil, freedom of thought is directly linked to freedom of expression, and this notion reflects the legal and human rights trajectory against censorship in the country and has an interpretation regarding intellectual rights. This interpretation does not exhaust the possibilities that freedom of thought can achieve in legal hermeneutics; it is merely a reading of the material and philosophical challenges that have prompted the right.

International declarations and conventions mark the right to mental integrity in the history of international law, one of the most relevant bases for neuro rights. In terminological terms, it is suggested that at least four rights of this nature be adopted in the legal realm: the right to cognitive freedom, the right to mental privacy, the right to mental integrity, and the right to psychological continuity. Other formulations translate an initiative related to the right to personal identity, the right to free will, and the right to mental privacy. As highlighted in a previous section, one of the concerns with neurotechnologies is that their commercial development proliferates social inequalities, which can make technology a privilege for a few. In this sense, a final right emerges, with equal access to mental improvements (Madrid; San Martin, 2021).

In the era of neurotechnologies, associating freedom of thought with freedom of belief or expression is insufficient. The historical antecedents of neuro rights are the institutes for protecting psychological and mental integrity, arising mainly from the environment protecting against gender-based violence and the recognition of various forms of psychological abuse (Ienca, 2021). Cognitive freedom and freedom of thought should be considered fundamental human rights but with a notion applied to regulating neurotechnologies to include these rights in legal systems as principles guiding the uses of neurotechnologies (Ienca; Andorno, 2017). The basis for this defense is the *sine qua non* condition of freedom of thought for exercising other rights. It is easier to conceive of a legal subject able to access other rights with the guarantee of freedom of thought, as it is the neurocognitive human substrate. It is conceivable that this freedom has unconditional protection, positioning it as one of the rare absolute rights that should prevail regardless of the context.

It is suggested that neuro rights should be enshrined in the Brazilian Federal Constitution through a Constitutional Amendment because constitutional guarantees are not mere precepts but legal principles that ensure explicit normative standards with an essence that can regulate the

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most diverse material situations. In Brazil, a legal initiative, through Draft Bill No. 522/2022, aims to amend the Brazilian General Data Protection Law (Lei Geral de Proteção de Dados) to include neural data as sensitive data and conceptualize what neural data is, brain-computer interface, and neurotechnology.

However, it is questioned whether the mere consideration of data protection is enough in an environment where these technologies affect more than data but the very cognitive freedom, personal identity, and mental privacy. Chile was the first country to provide special protection to neuro rights at a supra-legal level in Article 19-number 1 of its Constitution. In the article, the Constitution defines that scientific and technological development must serve people and respect individuals' physical and psychological integrity. It establishes that the law will regulate the specificities of using neurotechnologies in people but must safeguard cerebral activity and information from this sphere (Chile, 2005). In the same direction as Chile's pioneering efforts, it is understood that in Brazil, there should be an advancement to protect this category of rights supra-legally through an amendment to Article 5 of the Constitution as a fundamental right to include neural data, mental privacy, equal access to cognitive improvements, and the protection of neuro rights in the face of scientific and technological development.

5 Final considerations

The myth of Prometheus, which represented the gift and the curse of knowledge at the beginning of this work, presents metaphors similar to the considerations that can be made about the rise of neurotechnologies. The sacred fire is a gift that allows humanity to advance, build new ways of life, improve and develop new skills and treatments. But, on the other hand, it is also an impulse that can cause destruction and many rights violations. It is necessary, therefore, to balance the relationship between technological development and the protection of fundamental rights.

Neuro rights are an essential category for freedom of thought in contemporary times because understanding brain functioning and the practical interventions stemming from this understanding can drastically influence mental processes. This is a profound debate about autonomy, freedom, privacy, and the fundamental right to identity and non-maleficence. Freedom of thought is the basis for individual independence. It takes on even more expressive contours in a scenario where there is knowledge and external coercion over this basis of personal expression. The development of devices capable of monitoring, analyzing, and manipulating brain activity directly attacks thought as an intimate sphere, the deepest layer of human individuality.

Advances in neurotechnology have improved the quality of life for many people with neurological diseases, which profoundly impacts human dignity. At the same time, the ethical and responsible use of these technologies is a priority to ensure that cognitive freedom and freedom of thought are the default tone of their use. The regulation of neuro rights, especially

as international pacts for protecting brain data and mental information, is essential to position guidelines on using neural technologies. Moreover, it is suggested that a constitutional amendment for the supra-legal guarantee of neuro rights is indispensable to elevate the category to fundamental rights, influencing how laws and specific regulations will address such a topic. Participation in this change should be broad and multisectoral, with support for ethical research, education on neuro rights, transparency in the operations of organizations researching and implementing these technologies, and other initiatives to build a broad environment for the protection of freedom of thought.

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