MENTAL INTEGRITY AND ETHICS IN THE DEVELOPMENT OF NEUROTECHNOLOGIES

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ABSTRACT: *Although seemingly in an early stage, neurotechnologies are capturing the attention of international actors. The protection of fundamental human rights should be rethought or at least readjusted to the new challenges. Even though the issue addressed in this article may seem purely theoretical, it is crucial as neuroscience stands at the border between brain activity and what constitutes an individual's identity. The brain is not and cannot be considered as just another organ of the body. A person is much more than their neural activity, although this activity is necessary for a person to be the kind of individual they are. Therefore, the issue arises of developing an adequate legal framework for their use in tandem with new technologies.*

KEYWORDS: *neurotechnology; ethics; neuro-rights; mental integrity.*
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Neurotechnologies refer to a set of techniques and devices that interact with the human nervous system, including but not limited to: brain stimulation devices (implants or electrodes that can stimulate specific brain regions to treat conditions), neuroimaging devices (technologies such as magnetic resonance imaging or positron emission tomography that allow visualization of brain activity), brain-computer interface (BCI) devices (systems that enable direct communication between the brain and a computer), and neurofeedback technologies (which help users regulate their brain activity through real-time feedback). Among these categories, the last one may represent the most widespread and accessible option, as even at the time of this article's publication, numerous devices capable of capturing and interpreting neural frequencies are already available on the market.

Therefore, at this stage of evolution, neurotechnologies can be used to measure brain activity or to change brain activity. In other words, new neurotechnologies aim to record mental activity and alter mental activity. The goal is to decode and manipulate mental activity for scientific and medical purposes, as well as for commercial purposes. In fact, the vast majority of investments in these technologies come from the private sector.

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Some doctrinal opinions (Mircea, 2023) explained as early as 2023 that these technologies have progressed to such an extent that it is becoming predictable to graft an implant onto a human brain to enhance memory, limit depression, or suppress pain. In other words, it is theoretically possible that we may soon witness the creation of direct digital access to the human brain to augment, guide, or influence it.

Therefore, neurotechnologies have applications in medicine, education, entertainment, and the enhancement of cognitive performance. However, they also raise important ethical questions concerning privacy, consent, and their impact on human identity.

It is worth noting, however, that the discussion has an "apparently" early-stage character. Such a statement is important because it is well-known that these technologies already have their own history. Whether we speak of the electroencephalogram, which emerged in 1929, or the various brain activity monitoring techniques developed and practiced in the 1950s, there is a solid scientific foundation for these technological innovations.

Furthermore, the use of EEG and EMG is based on discoveries made by two Italian scientists at the end of the 18th century regarding bioelectric activity in the body. The „dispute" between physician Luigi Galvani and physicist Alessandro Volta was later settled by the German physician Emil Heinrich DuBois Reymond, giving rise to what we know today as EEG technology. Recent technological leaps in neuroscience and artificial intelligence have merely facilitated the provision of neurotechnological devices for consumers. Essentially, we are talking about devices that connect the human brain to computers, along with the complex algorithms that allow these computers to analyse the data they receive. Initially, researchers dismissed all these consumer-oriented devices as inaccurate and medically unverified, labelling them as nothing more than toys.

As both hardware and software improved, consumer neurotechnology became increasingly precise and harder to ignore. At present, an average person familiar with contemporary common technology can monitor brain impulses, emotions, focus, and even alertness.

While acknowledging that there is some relativity in tracking emotions (Liu, 2011), researchers use a two-dimensional model known as *Arousal-Valence*[1]. However, the main drawback of algorithms operating based on this emotion recognition theory is their lack of accuracy. At this time, there is insufficient research to determine precise reading and interpretation parameters, especially given the multitude of stimuli in everyday life.

Globally, the neurotechnology market is growing and is expected to reach $21 billion by 2026. Consumers can see graphical displays of their brain wave activity in real-time – delta (deep sleep, without dreams), theta (deep relaxation, introspection), alpha (very relaxed state/meditation), beta (alertness, engagement, stress), and gamma (concentration) – as well as blood flow patterns in their brain and even bioelectric changes in their muscles.

However, returning to September 2024, the Blindsight visual prosthesis developed by Neuralink was designated as an innovative device by the U.S. Food and Drug

[1] A two-dimensional emotion labeling model used for the graphical representation of emotions along two main axes: 1. Arousal (activation) – a parameter that measures the intensity of the emotion, ranging from calm or low-energy emotions (e.g., sadness, relaxation) to intense or high-energy emotions (e.g., anger, excitement, fear). 2. Valence – a parameter that measures the positive or negative nature of the emotion. For example, pleasant emotions such as joy or excitement have positive valence, while unpleasant emotions such as sadness or fear have negative valence.

Administration, which will result in an accelerated pace of development for the technology. It is important to note, however, that designation as an innovative device does not mean that Blindsight is considered safe or effective. Technologies labelled as such have the potential to improve the current standard of medical care and are new compared to what is available in the medical device market, but they still need to go through full clinical studies before seeking final FDA approval.

Moreover, one month after Elon Musk's success, researchers at Princeton University (Dorkenwald, 2024) completed the brain mapping of an insect. The project began in 2013 and was expected to be a long-term endeavour. The researchers sectioned the insect's brain into 7,050 parts and produced approximately 21 million images. However, with the development and use of artificial intelligence, the time required to complete the project was drastically reduced. The use of new technologies exponentially increased the capacity for image analysis and processing, shortening the project's completion time by years. Researchers involved in this study concluded that "mind uploading was a science fiction fantasy, but now mind uploading – at least for a fly – is becoming mass science," said Dr. Seung.

No matter how much media exposure Elon Musk receives, we must still be aware that these technologies have experienced exponential development in recent years in China as well. Train conductors on the Beijing-Shanghai high-speed line, probably the busiest in the world, are required to wear EEG devices while on duty (Jiangfan Chen, 2022) to ensure they remain focused and attentive.

Therefore, regarding concentration and vigilance, there is a study (Robin R. Johnson, 2011) whose results indicated that an EEG-based algorithm, personalized using a series of short "identification" tasks, was able to efficiently track performance declines associated with sleep deprivation. Researchers focused on detecting drowsiness due to the functional impairments caused by fatigue, which impact public health, public safety, and productivity. In this regard, SmartCap Technologies began producing and primarily marketing devices with built-in EEG sensors in Australia. These devices can be worn as they are or integrated into accessories such as workers' safety helmets or simple caps. The data obtained from processing the captured information are then analysed by software using algorithms to provide a risk score based on the user's ability to resist sleep.

Given such technological and scientific developments, in 2021, the Republic of Chile recognized the need for legislative adaptation. Thus, the Chilean Senate unanimously approved a bill to amend the constitution to protect brain rights or "neural rights." The Chamber of Deputies reviewed and approved the amendment in September 2021. Chile was supposed to become the first country in the world with specific legislation to protect mental privacy, free will, and non-discrimination in citizens' access to neurotechnology. Although the proposed constitutional revision did not pass the 2021 referendum nor the one in 2023, this perspective is commendable, even if materialized in a nearly outdated initiative.

However, Chile is not the only country concerned about the legal gap surrounding neurotechnologies. Spain, the USA, France, and more recently UNESCO have recognized the benefits of neurotechnology, but also its potential ethical issues.

Unlike many other cutting-edge technologies, neurotechnology can directly access, manipulate, and emulate the structure of the brain, and with it, can produce information about a person's identity, emotions, and fears. Combined with artificial intelligence, these could easily become a threat to the concepts of human identity, human dignity, freedom of thought, autonomy, and mental privacy.

Starting with the initial meeting of the Ad Hoc Expert Group (AHEG) in April 2024, UNESCO began the development of its first draft recommendation on ethics in the development of neurotechnologies. This text underwent an extensive consultation process to gather the views of a wide range of stakeholders, ensuring an open and inclusive drafting process. Over 25 consultations took place at regional, subregional, and national levels between June and July 2024, alongside a global online survey.

In fact, UNESCO initiated a two-year process for the development of the first global Recommendation on the Ethics of Neurotechnology. This special mandate, entrusted by UNESCO's 194 member states at the 42nd session of the General Conference in November 2023, aims to establish a comprehensive framework of common values and principles, identify ethical challenges, and propose concrete policy actions to ensure the ethical development, implementation, and use of neurotechnology worldwide.

Concluding this effort, from August 26-30, 2024, AHEG will meet in Paris to review and finalize the first draft of the recommendation on the ethics of neurotechnology. Subsequently, this first draft will be shared with member states (September 2024), marking the beginning of the intergovernmental consultation process, which will extend until 2025.

The International Bioethics Committee (IBC) of UNESCO addressed these concerns as early as 2021 through a forward-looking report, *Ethical Issues in Neurotechnology*, highlighting five main ethical challenges: (1) brain/mental integrity and human dignity, (2) personal integrity and psychological continuity, (3) autonomy, (4) mental privacy, and (5) accessibility and social justice.

UNESCO's effort underscored the necessity of creating a solid model for global governance, positioning the Organization as an optimal space for leading an international debate aimed at developing such a framework.

This led to the foundation of seven common values: (1) respect for, protection, and promotion of human rights, fundamental freedoms, and human dignity; (2) promotion of human health and well-being; (3) ensuring and respecting diversity, inclusion, non-discrimination, and equity; (4) considering intercultural perspectives on human knowledge and its sharing; (5) cohabitation in peaceful, fair, and just societies; (6) global solidarity; (7) sustainability, responsibility, accountability, and responsiveness.

It was concluded that neurotechnology should never be used in ways that objectify, exploit, or undermine the dignity and rights of an individual. In this context, UNESCO also developed a set of ethical principles, which extend the common values: the principle of beneficence and proportionality; the principle of freedom of thought and self-determination; the principle of mental privacy and protection of neural data; the principle of reliability, fairness, and non-discrimination; the principle of epistemic and global justice; and the principle of the best interests of the child and the protection of future generations.

As strategic areas of action, the project works with different types of beneficiaries and usage examples. Specifically focusing on the impact of neurotechnologies on children, young people, adults, the elderly, and individuals with physical or mental disabilities, particular attention has been given to the issue of children. In this context, the rule of valid consent must be adapted to the maturity and decision-making capacity of minors, considering the differences in neural development. Regarding the elderly, member states must support a healthy aging process, preventing or at least facilitating the monitoring of age-related diseases.

For individuals with physical or neurological disabilities, the aim is to achieve equality of opportunity and treatment, through the development and use of technologies that address or even eliminate neuromorphological deficiencies. There are also specific provisions related strictly to the field of Health, including the creation of a mechanism for the continuous monitoring of neurotechnology use, ensuring the documentation of any potential long-term consequences, which are currently unknown.

At this stage, the UNESCO initiative is at a point where it will be shared with member states, marking the beginning of the intergovernmental consultation process, which will continue until 2025.

Although welcome, we consider that these *soft-law* initiatives appear to be insufficient in preventing the onset of significant risks. We believe that the way the right to mental privacy will be implemented is just as important as its explicit recognition. Clearly, achieving this goal will require sustained effort and multidisciplinary and intergovernmental collaboration alongside corporations, academics, and civil society, to define clear limits on the use of emerging technologies and the manner in which data resulting from their use can be utilized.

Swiss bioethicist Marcello Ienca and law professor Roberto Adorno have called on the UN to recognize a new human right to mental privacy (Marga, 2022) “to protect any information or set of information about an individual’s brain recorded by a neuro device and shared in the digital ecosystem.” They consider this right to be relative, “which may be limited under certain circumstances, provided that such restrictions are a necessary and proportional way to achieve a legitimate aim.” A group of ethicists and legal experts, known as the Morningside Group, has called for a similar right, but as an absolute right, where “any interference by states is prohibited without a clear and justified purpose.”

However, the question arises whether a new right to mental privacy is necessary, or whether this human value, so vulnerable in the 21st century, can be defended through interpretation under existing legal frameworks. The legitimacy of this question stems from the fact that privacy and freedom of thought are already protected by Article 12 of the Universal Declaration of Human Rights, which states that “no one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, nor to attacks upon his honour and reputation,” and Article 18, which reaffirms that “everyone has the right to freedom of thought.”

It is unequivocal that as societal and technological changes expose gaps in the interpretation of existing rights, we should update the application of human rights in these new contexts, or we might intervene more decisively by revising and adding provisions to address the grey areas in interpretation.

The solution of evolutionary interpretation seems in line with the perspective of the International Court of Justice, which holds that the “generic” terms in treaties were written in this way precisely to allow for an evolving process of interpretation, in full harmony with society and the changes within it. However, evolutionary interpretations do not seem to resolve the issue of legal norm ambiguity, and it should be noted that they specifically rely on the evolving linguistic meaning of the term being interpreted, which involves changes in meaning influenced by external factors such as social, technological, or economic changes, which affect the very context in which the term is used.

Therefore, we can say that a "basic layer" of protection exists. However, another obvious gap arises from the nature of human rights, which are often not *horizontally applicable*, meaning they do not apply to or obligate private actors. Many concerns related to neurotechnology in current ethical debates or international organizations' reports stem from the behaviour of private actors, such as mental surveillance in the workplace or measuring consumers' brain reactions without consent, especially in the digital environment. As such, privacy interests are covered by the basic layer and will need to be balanced against opposing interests. Ultimately, gaps in applicability in relationships with private actors could be filled through the introduction of new legislation (Bublitz, 2024).

Finally, due to the importance of the protected value and the premise stated at the beginning of the paper, namely that the brain is not and cannot be viewed as just another organ of the body, and that a person is much more than their neuronal activity—which is essential for a person to be the type of person they are—we believe there is no room for superficiality in addressing the subject of neurotechnologies and neuro-rights. In contrast, some scholars argue that the call for "neuro-rights to protect us from mind-reading" suggests an imaginative reasoning based on unlikely technological outcomes (Gilbert, 2024). The if-then-therefore approach, particularly applied to AI and based on prophetic claims, risks turning neuroethics into a narrative exercise rather than a rigorous scientific discipline. From our perspective, we believe that while the expectation of impressive technological achievements may create vulnerability in the legal framework underpinning neuroethics, we cannot afford to approach potential harmful effects in such a simplistic manner.

Establishing standards in international human rights law is an important first step toward setting social norms and moral obligations for governments, corporations, and individuals. Even so, simply updating legal provisions to explicitly include mental privacy will not change human behavior. For these standards to be effective, there must also be enforcement mechanisms at the national level; therefore, an appropriate legal framework is preferable.

In conclusion, this brief ethical-legal reflection makes it clear that, in the face of the novelty and complexity of the issues arising from the use of neurotechnologies, the legal effort directed exclusively at adapting and creatively interpreting existing legal texts is welcomed but insufficient.

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