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NEUROTECHNOLOGY AND HUMAN RIGHTS IN EUROPE: TOWARDS A LEGAL-NEUROETHICAL FRAMEWORK

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Abstract

Neurotechnology is advancing rapidly and offers revolutionary benefits, yet it also raises significant ethical and legal challenges. This article examines how the European human rights framework addresses these challenges, with particular attention to the emerging concept of "neurorights", which include cognitive liberty, mental privacy, mental integrity, and psychological continuity. European Union law and the European Convention on Human Rights provide strong protection for privacy, data, and freedom of thought, but because these instruments were not designed with neurotechnology in mind, they present substantial gaps in protection. A comparative analysis with the case of Chile, where neurorights have been constitutionally recognised, highlights both the urgency and the feasibility of legal adaptation. The article proposes a European legal and neuroethical framework to proactively safeguard mental autonomy, including reinforced protections for brain data, explicit recognition of cognitive liberty, ethical oversight mechanisms, and citizen participation. It also recommends integrating neurorights into EU legislation, reinterpreting existing human rights in light of neurotechnological developments, and fostering international cooperation to ensure consistent standards. Ultimately, the article presents the protection of the mind against unauthorised access or manipulation as the new frontier of human rights. Europe, with its strong legal tradition, is in a privileged position to lead the incorporation of these safeguards and to ensure that neurotechnology evolves in harmony with human dignity, freedom, and justice.

Keywords: neurorights; data protection; cognitive liberty; mental autonomy; European Union.

NEUROTECNOLOGIA I DRETS HUMANS A EUROPA: CAP A UN MARC JURÍDIC I NEUROÈTIC

Resum

La neurotecnologia està avançant ràpidament i ofereix beneficis revolucionaris, però també planteja reptes ètics i jurídics importants. Aquest article analitza com el marc europeu de drets humans afronta aquests reptes, amb una atenció especial al concepte emergent dels neurodrets (neurorights)*, que inclouen la llibertat cognitiva, la privacitat mental, la integritat mental i la continuïtat psicològica. Tot i que el dret de la Unió Europea i el Conveni Europeu de Drets Humans proporcionen una protecció sòlida de la privacitat, les dades i la llibertat de pensament, aquests instruments no van ser dissenyats pensant en la neurotecnologia, de manera que presenten llacunes significatives en la protecció. L'anàlisi comparativa amb el cas de Xile, on els neurodrets han estat reconeguts constitucionalment, posa de manifest tant la urgència com la viabilitat d'una adaptació legal. L'article proposa un marc europeu jurídic i neuroètic per salvaguardar proactivament l'autonomia mental, que inclogui una protecció reforçada de les dades cerebrals, el reconeixement explícit de la llibertat cognitiva, mecanismes de supervisió ètica i la participació ciutadana. Es recomana integrar els neurodrets en la legislació de la UE, reinterpretar els drets humans existents tenint en compte els desenvolupaments neurotecnològics i col·laborar internacionalment per garantir estàndards coherents. En última instància, es presenta la protecció de la ment davant l'accés o la manipulació no autoritzats com la nova frontera dels drets humans. Europa, amb una tradición jurídica sòlida, es troba en una posició privilegiada per liderar la incorporació d'aquestes garanties i assegurar que la neurotecnologia evolucioni en sintonia amb la dignitat humana, la llibertat i la justícia.*

Paraules clau: neurodrets; protecció de dades; llibertat cognitiva; autonomia mental; Unió Europea.

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1 Introduction

Neurotechnology – from brain–computer interfaces (BCIs) to neural implants – is no longer confined to science fiction; it is rapidly becoming a reality with profound legal and ethical implications. Devices such as non-invasive electroencephalogram (EEG)-based headsets are capable of recording, and potentially influencing, the human brain's activity (Muhammad et al., 2023). Technologies like this promise tremendous benefits (e.g., helping paralysed patients to communicate or control prosthetics by thought), but also raise unprecedented concerns for cognitive liberty and mental privacy. In essence, neurotechnology blurs the once-sacrosanct boundary between the external world and the inner workings of the mind.

If a person's intentions, preferences, and emotions can be inferred from brain data, or if an external device can alter their neural activity, how do existing human rights safeguards apply? This is an urgent question in Europe, where the legal framework – including European Union (EU) law and the European Convention on Human Rights (ECHR) (Council of Europe, 1950, November 4) – prides itself on robust fundamental rights protections. Yet, scholars and policymakers are asking whether current laws are sufficient to protect neurorights – a set of emerging rights aimed at safeguarding the brain and mind (Yuste et al., 2017; Goering et al., 2021).

This article examines how European human rights law applies (or fails to apply) to neurotechnology and BCIs, providing a legal and ethical analysis of current protections and gaps, and drawing comparisons with Chile's pioneering neurorights amendment and other national initiatives. Finally, it proposes elements of a European legal-neuroethical framework that would proactively secure key neurorights – especially cognitive liberty, mental privacy, mental integrity, and psychological continuity – in the face of advancing neurotechnology.

2 Neurotechnology and the rise of neurorights

Neurotechnology broadly refers to techniques and devices that directly interact with the nervous system to monitor or influence brain activity. Today's state of the art ranges from non-invasive BCIs (such as the above-mentioned EEG headsets that detect brainwaves) to invasive implants (e.g., microchips) that record neural signals or stimulate brain regions for therapeutic ends. For example, researchers have enabled patients with amyotrophic lateral sclerosis (ALS) to move cursors or robotic limbs via implanted electrodes by interpreting their neural signals (McFarland, 2020). In laboratories, machine learning algorithms decode functional magnetic resonance imaging (fMRI) and EEG data to determine the images a person has seen, or even which among a set of actions they intend to perform, sometimes with striking accuracy (Du et al., 2022). Meanwhile, companies are piloting "mental surveillance" in less benign contexts: reports from China indicate factory workers being required to wear EEG sensors in helmets to monitor attention and emotional states, raising concerns of workplace manipulation and privacy invasion (Winick, 2018). These technological capabilities – reading brain states and potentially writing into the brain – were once imaginable only in dystopian fiction such as the television series *Black Mirror*. Now they are demanding our ethical and legal attention in the real world.

Neuroethics as a field has arisen to grapple with these dilemmas (Farisco, 2023), and out of neuroethics has come the concept of "neurorights". Neurorights are proposed fundamental rights and freedoms designed to protect the individual's mental domain against the power of neurotechnology. Early visionaries like Boire (2001) and Sententia (2004) introduced the notion of "cognitive liberty" – essentially, the right to control one's own consciousness and mental processes – as a foundational freedom in the neurotechnology age. They argued that cognitive liberty is the necessary substrate for all other freedoms, given that our capacity to think freely underpins our ability to make autonomous decisions (Ienca, 2021b). Building on this, legal

scholars such as Bublitz (2013) advocated recognising cognitive liberty (or "mental self-determination") as a basic human right to guarantee the individual's sovereignty over their own mind.

In 2017, a landmark proposal by Ienca and Andorno crystallised a set of four specific neurorights: (1) the right to cognitive liberty, (2) the right to mental privacy, (3) the right to mental integrity, and (4) the right to psychological continuity. Cognitive liberty, in its formulation, is a "negative right" that safeguards individuals from coercive or non-consensual uses of neurotechnology. Mental privacy is the right to keep one's thoughts, feelings, and neuronal data free from unauthorised collection or disclosure – protecting brain information before it is externalised in speech or action. Mental integrity is the right to be free from harmful manipulations of one's mental processes – extending the notion of "bodily integrity" to the mind and guarding against interventions that could inflict psychological harm or alter mental functioning without consent. Finally, psychological continuity refers to the right to preserve one's personal identity and the continuity of the self over time, shielding the "mental substrates of personal identity" from alteration by third parties via neurotechnology (Ienca & Andorno, 2017a). These proposals were an explicit response to the perceived shortcomings of existing international and EU rights – for instance, those included in the European Charter of Fundamental Rights (European Union, 2012) – in the face of neurotechnology's new capabilities. Indeed, Ienca and Andorno concluded that while current human rights legislation on privacy or freedom of thought is necessary, it may not be sufficient to address emerging neural threats that call instead for a reconceptualisation or expansion of protections (Ienca & Andorno, 2017b).

Neuroscientists also joined the conversation. That same year, 2017, Yuste and a group of 25 leading researchers published an influential piece advocating for the addition of neurorights to international human rights treaties, making specific mention of rights concerning privacy, personal identity, free will, and equal access to augmentation (Yuste et al., 2017). They highlighted four broad areas of concern: "privacy and consent, agency and identity, augmentation, and bias", calling for the corresponding neurorights to be enshrined to pre-empt abuses. This generated worldwide interest and gave rise to doctrinal debates (Amoedo Souto, 2018) as well as political discussions, particularly in response to campaigns led by Yuste and others through the Neurorights Foundation to promote concrete legal reforms. During 2021, international organisations began to respond. For example, the Organisation for Economic Co-operation and Development (OECD) (Organisation for Economic Co-operation and Development, 2019) issued a recommendation on responsible innovation in neurotechnology – the first international standard in the field – which emphasises human rights, safety, and inclusiveness in the development of neurotechnology. Similarly, in 2021, the United Nations Education, Scientific and Cultural Organization (UNESCO) International Bioethics Committee released a report on the ethical issues of neurotechnology, calling for a comprehensive governance framework and raising neurorights as a salient concern (International Bioethics Committee, 2021). In fact, by the end of 2025, UNESCO will lead a debate with its 194 Member States to adopt a global framework on the ethics of neurotechnology (United Nations Education, Scientific and Cultural Organization, 2024).

In summary, state-of-the-art neurotechnologies pose significant possibilities and perils alike. Ethicists and legal scholars have coalesced around the notion of neurorights as a way to future-proof human rights against these neurologically invasive capacities. The key neurorights – cognitive liberty, mental privacy, mental integrity, and psychological continuity – have emerged as guiding principles that any new framework should address. The next sections examine to what degree Europe's current legal regime measures up against these principles and identify the gaps that remain.

3 Human rights and neurotechnology in Europe: current frameworks and gaps

Since 2022, the EU has regulated non-medical neurotechnologies through two implementing regulations (Commission Implementing Regulation [EU] 2022/2346; Commission Implementing Regulation [EU]

2022/2347) issued under the Medical Devices Regulation (Regulation [EU] 2017/745). This constitutes the world's first binding regulation of non-medical neurotechnologies and includes specific rules for different types of devices, including brain stimulation devices, which apply electrical currents or magnetic fields to modify neuronal activity in the brain (Commission Implementing Regulation [EU] 2022/2346, Annex VII). However, the legislation fails to address current ethical concerns such as the impact of these technologies on personal identity or authenticity, or issues of bias and discrimination. For example, Article 3.3 of Annex VII of Commission Implementing Regulation (EU) 2022/2346 refers to psychological risks and long-term effects on brain functioning, but it remains unclear whether this provision covers the risk that an individual's thoughts, opinions, or emotions could be revealed or manipulated through consumer neurotechnologies (Bublitz & Ligthart, 2024).

To address issues such as these, the European legal landscape offers two main instruments for the protection of human rights: (1) the Charter of Fundamental Rights of the European Union (the Charter), which is binding on EU institutions and on Member States when implementing EU law; and (2) the ECHR of the Council of Europe, which is binding on all 46 Member States, encompassing most countries on the European continent. These instruments enshrine rights that, at first glance, appear relevant to neurotechnology, such as rights to privacy, data protection, freedom of thought, and bodily integrity. However, closer analysis reveals ambiguities in the way they apply to BCIs and to neurorights, leaving potential gaps in protection.

First, regarding the rights to privacy and data protection, Article 8 of the ECHR guarantees the right to respect for private life, which the European Court of Human Rights (ECtHR) has interpreted broadly to include protection of personal data and aspects of one's identity and psychological well-being. Notably, the ECtHR has stated that "private life" encompasses a person's physical and psychological integrity (e.g., *Case of X and Y v Netherlands*; *Case of Bensaid v the United Kingdom*). In *Bensaid v the United Kingdom*, the ECtHR recognised that mental health is a crucial part of private life, linking psychological integrity to Article 8 protection. This jurisprudence suggests that the invasion of an individual's mental sphere – such as unwanted extraction of brain data or psychological manipulation – could be seen as interference with private life requiring justification under Article 8. Moreover, the right to privacy in Article 8 protects the inner domain of an individual, which arguably includes unexpressed thoughts and feelings. However, ECtHR case law has yet to be confronted with a scenario of neuronal data interception or brain surveillance, so the contours of protection remain untested. One could even analogise to related contexts: for instance, the ECtHR has found that surveillance of communications, if not adequately safeguarded, violates privacy (e.g., *Case of Big Brother Watch and Others v the United Kingdom*). By extension, surveillance of brain activity (e.g., covert brainwave monitoring) should trigger even stronger scrutiny, as it targets the mind's innermost sanctum.

On the EU side, Article 7 of the Charter mirrors ECHR Article 8 on the protection of private life, while Article 8 explicitly guarantees personal data protection. The EU's General Data Protection Regulation (GDPR, Regulation [EU] 2016/679) provides a rigorous framework for personal data, including sensitive health and biometric data. Brain data, if linked to an identified or identifiable person, often qualify as both health data and biometric data, since EEG or fMRI patterns can be unique to individuals. In a 2024 joint report, the Spanish Data Protection Agency (AEPD) and the European Data Protection Supervisor (EDPS) highlighted that neural data can indeed be personal data, and often of a special category, given that such data may reveal "the most intimate personal thoughts and feelings" (Agencia Española de Protección de Datos, & European Data Protection Supervisor, 2024). Thus, European data protection law in principle covers many neurodata scenarios, imposing requirements of consent, purpose limitation, data minimisation, and robust security for entities processing brain data. The GDPR also incorporates rights such as not being subject to solely automated decisions without consent, when such decisions have legal or similarly significant effects (Regulation [EU] 2016/679, Article 22). In this respect, a future AI system that were to decode brain data – for example, to assess job applicants or criminal suspects – would raise such concerns. However, gaps

remain. If brain data are truly anonymised (i.e., not linked to an individual's identity), they fall outside the GDPR, although even anonymised neurodata could potentially be re-identified or reveal sensitive mental traits. More importantly, the GDPR was not written with BCIs in mind; concepts like "data concerning health" did not envision real-time cognitive/emotional states being captured from consumer devices. Enforcement is another challenge: companies outside Europe (e.g., a neurotechnology in the United States sending EEG headbands into Europe) may not easily fall under EU jurisdiction unless they target EU users. Finally, privacy law does not directly address the unique harm of having one's thoughts exposed or altered, beyond treating it as a data breach or illicit processing. Mental privacy, as conceived by neurorights advocates, is a broader concept that demands the right to keep one's mind inviolate, not merely one's personal data.

Second, freedom of thought and cognitive liberty are also regulated in Europe. Freedom of thought is protected in absolute terms, alongside freedom of conscience and religion, under Article 9 of the ECHR and Article 10 of the Charter. In human rights law, the *forum internum* – the inner realm of thoughts and beliefs – is inviolable: the state must not intrude or coerce in this domain. In practice, however, freedom of thought has been underlegislated, partly because direct intrusions into thoughts were historically impossible. Now, neurotechnology may force a renaissance of this forgotten freedom. If a technology allows the government or employers to read minds (even imperfectly) or subliminally influence thoughts (through neurostimulation or persuasive neuroadvertising), it could breach the *forum internum*. Some scholars argue that we need to revitalise freedom of thought in the digital age to address emerging threats from neurotechnology and even AI-based profiling (Alegre, 2017). At the very least, cognitive liberty could be interpreted as an aspect of freedom of thought: the right not to have one's thought processes monitored or altered without consent. The challenge is largely doctrinal: courts and regulators would need to apply existing law in novel ways. Might we see, for example, a citizen complaining to the ECtHR that a mandatory neural sensor – perhaps imposed for national security screenings or in an employment setting – violated their Article 9 freedom of thought? It is uncharted territory, but the legal basis exists in principle. The absolute nature of the *forum internum* means that no justification, not even national security, can excuse an intrusion into an individual's mind – a powerful protection if invoked. The gap may lie in not recognising such acts as intrusions in the first place; legal systems should thus become attuned to the realities of potentially invasive neurotechnology.

Third, with regard to mental integrity and non-discrimination, Article 3 of the Charter states that "everyone has the right to respect for his or her physical and mental integrity". However, this provision has mostly been applied in contexts such as bioethics (e.g., informed consent to medical treatment, prohibition of eugenic practices, etc.). The drafters of the Charter likely did not imagine "mental integrity" being threatened by technological hacks or manipulation. In this sense, Ienca and Andorno (2017) have argued that "the right to mental integrity should not exclusively guarantee protection from mental illness or traumatic injury but also from unauthorized intrusions into a person's mental well-being performed through neurotechnology". In the ECHR framework, mental integrity is not explicitly mentioned, but the ECtHR has incorporated it into privacy (as discussed) and sometimes into the prohibition of inhuman treatment (ECHR, Article 3) in extreme cases (e.g., interrogation involving the use of drugs or psychological abuse). Yet, psychological continuity – the idea of preserving one's personal identity over time – is not explicitly a right in European instruments, although aspects of it surface via the rights to identity and private life. The ECtHR has recognised a "right to identity and personal development" as part of Article 8 (e.g., *Case of Odièvre v France*). One could argue that unwarranted external modification of someone's personality (imagine a brain implant that alters your memory or impulse control without consent) would impair that right to identity and personal development. But once again, this is an argument by analogy since we lack direct legal precedents.

Finally, another important concern is equality and non-discrimination. European law – Article 21 of the Charter and Article 14 of the ECHR – robustly forbids discrimination and emphasises equal access. Neurotechnology could impact these rights in two ways: (1) discriminatory use of neurodata could conceivably lead employers or insurers, for instance, to use neural profiles to screen candidates or customers

and reject individuals whose brain signals suggested a mental health risk or "undesirable" tendencies, raising alarms under data protection and equality law; and (2) if mind-enhancing BCIs were to become available, ensuring equitable access could become a policy issue, to avoid the creation of a neuro-technologically enhanced elite (paralleling discussions around genetic enhancements or AI access). Chile's framework explicitly lists non-discrimination in access to neurotechnology as a neuroright (discussed further below). The EU does not yet have such specific clause, but principles of justice and existing disability rights law might support calls for accessibility and fairness in distribution of beneficial neurotechnology, for example, by ensuring that people with disabilities who could benefit from BCIs receive them under public healthcare provision.

In summary, current European human rights law *does* provide a patchwork of protections that cover elements of neurorights: privacy can extend to mental privacy; freedom of thought provides a basis for cognitive liberty; data protection laws regulate neurodata to an extent; and dignity and integrity concepts gesture towards protecting the mind. However, these protections are non-specific and incomplete. They were developed for analogue situations and require reinterpretation to fully address neurotechnology. Presently, there is no clear, specific legal instrument in the EU or ECHR system that addresses neurotechnology or neurorights head-on, and this contrasts with the proactive stance taken in some other jurisdictions. This gap has led to growing calls in Europe for more explicit legal recognition of neurorights or, at least, detailed guidance on applying existing rights in this context (European Parliament, 2023). The following section turns to Chile and other countries that have moved faster in this regard, to glean lessons for Europe.

4 Comparative perspectives: neurorights in Chile and other national initiatives

While Europe continues to deliberate, Chile has made history by becoming the first country to explicitly enshrine neurorights into its legal framework (Cornejo-Plaza et al., 2024). In late 2021, the Chilean Congress approved a constitutional amendment to Article 19 of its Constitution, making Chile the world's pioneer in legislating "brain rights". Particularly, Law No 21.383 was enacted in October 2021. This legislation amended the final clause of Article 19.1 of the Chilean Constitution to explicitly protect mental integrity in the context of emerging neurotechnologies. The revised clause states: "Scientific and technological development shall be at the service of individuals and shall be carried out with respect for life and physical and psychological integrity" (Political Constitution of the Republic, Government of Chile [own translation]).

Thus, the amended text requires technological development to respect the physical and mental integrity of the individual, and states that the law especially must protect brain activity and brain-generated information. In effect, Chile has elevated the protection of the mind to constitutional status, recognising that neurotechnology could threaten fundamental aspects of personhood such as free will and privacy (McCay, 2024). The legislative history shows the influence of the neurorights discourse: Chile's law was directly inspired by the work of Yuste and others, aiming to pre-empt scenarios where, for example, an invasive BCI could be used to manipulate someone's decisions or reveal their private thoughts. Specifically, Chile's neurorights amendment focuses on mental privacy, free will (cognitive liberty), and non-discrimination in access to neurotechnology. It treats personal brain data as akin to an organ of the body, that is not to be bought, sold, or manipulated. This bioethical framing (brain data = organ) underscores the idea that the brain's information is an intrinsic part of the person and deserving of the highest protection.

Chile did not stop at amending its Constitution. It has also been developing implementing legislation in the form of a draft neuroprotection law (Bill on the protection of neuro-rights and mental integrity, and the development of research and neurotechnologies), and saw a landmark case reach its Supreme Court. In *Girardi/Emotiv Inc.*, the Chilean Supreme Court examined whether the collection of brain data via a commercial EEG headset (the Emotiv "Insight" device) violated constitutional rights. The case was brought

by a former senator, Guido Girardi, after he tried an EEG headset that gathered neurodata and sent it to the company's cloud. Girardi argued that this infringed his right to privacy and mental integrity. In August 2023, the Supreme Court issued a constitutional relief (*recurso de protección*) ruling which, significantly, recognised that neurodata require heightened protection. The Court determined that, although Chile's data protection law was outdated, neurodata represent "the most intimate aspects of human personality", which the current regulations were not sufficient to safeguard. The ruling implied that neurodata – even if not always "personal data" under strict definitions – demand a special category of protection due to their sensitivity, thus echoing the neurorights argument: existing frameworks fall short, and new approaches (constitutional principles, stronger consent requirements, perhaps treating neurodata as *sui generis*) are necessary to defend human dignity in the face of these technologies. This Chilean case is one of the first anywhere to directly tackle neurorights in a court of law. It demonstrates both the possibilities – in that courts can adapt and recognise novel rights – and the challenges, since gaps in the existing laws forced judges to reach for constitutional principles.

Beyond Chile, the neurorights movement has spurred initiatives in other countries, particularly in Latin America. For example, Mexico is considering amendments to its Constitution to recognise neurorights. As of early 2024, a bill is pending in the Mexican Congress proposing to enshrine rights such as mental privacy, personal identity, cognitive autonomy, and informed consent for brain data use (Lagunes Soto Ruiz, 2024). The proposal explicitly mirrors the language of Chile's amendment, indicating a regional diffusion of the concept. Similarly, in 2023, Brazil introduced a proposal (Rodrigues, 2023) to amend its Constitution with the aim of protecting mental integrity and addressing algorithmic bias in the neurotechnological sphere. This proposal was officially incorporated into the Constitution of the Brazilian State of Rio Grande do Sul on 20 December 2023 (Constitutional Amendment No 85/2023, Article 235).

In the United States, three states are currently regulating neurotechnologies. The first to do so was Colorado, which in March 2024 included neural data in the definition of sensitive data under its privacy law, thereby becoming the first U.S. jurisdiction to explicitly regulate brain data in these terms (Law 24-1058, 26 March 2024). In the same year, California amended its Consumer Privacy Act in a similar way (Law SB-1223, 30 September 2024). More recently, Montana adopted a provision adding neurotechnology to its Genetic Privacy Act (Law SB-163, 26 March 2025).

In Europe, soft law initiatives and expert debates on neurorights have begun to emerge, although no country has yet adopted a reform comparable to that of Chile. In Spain, the Digital Rights Charter has been in place since 14 July 2021, wherein Article XXVI is dedicated to digital rights in the use of neurotechnologies (Government of Spain, 2021). The article closely mirrors the neurorights proposal advanced by Yuste et al. in 2017, although it does not explicitly mention freedom of thought (Rollnert Liern, 2024). Furthermore, as noted above, the AEPD and the EDPS published a TechDispatch report on neurotechnology in 2021 to raise awareness among regulators. More recently, in July 2025, the region of Cantabria introduced a draft digital health bill aimed at protecting neurorights and data derived from the brain (Linde, 2025).

In 2023, the UK Information Commissioner's Office published a report on the privacy and civil liberties implications of neurotechnology (Information Commissioner's Office, 2023). At the same time, the Bioethics Committee of the Council of Europe issued a report (Ienca, 2021a) and convened a high-level roundtable explicitly asking the question: "Neurotechnologies and human rights: do we need new rights?" (Council of Europe & Organisation for Economic Co-operation and Development, 2021, November 9). The event, co-organised with the OECD, acknowledged the challenges that neurotechnology poses in terms of privacy, autonomy, integrity, and discrimination, and raised the question of whether new rights – such as cognitive liberty or mental privacy – should be recognised. Although no formal declaration resulted, the very opening of this debate indicates that Europe is aware of the global trend towards neurorights and is cautiously

considering available options, ranging from reinterpreting existing rights to developing new standards or guidelines.

The comparative lesson is clear: legal systems are starting to adapt, but unevenly. Chile's bold constitutional approach provides one model – binding, high-level safeguards that treat neurorights as fundamental rights. Mexico and Brazil may follow suit in constitutional or statutory form. The United States is inching forward via state-level privacy laws. Europe has strong general human rights and data protection laws but no neuro-specific provisions yet. This sets the stage for Europe to consider how it wishes to position itself: will it rely on the flexibility of existing rights, or proactively define a neurorights framework? The final section outlines a proposal for the latter: a European, legal-neuroethical framework that synthesises the insights drawn from the above analyses.

5 Towards a European legal-neuroethical framework

The EU is taking steps to regulate neurotechnology from an ethical perspective. In October 2023, the European Ministers for Telecommunications and Digital Affairs met in León (Spain) to sign a joint declaration promoted by the Spanish Presidency of the Council of the EU, calling for the development of human-centred neurotechnology that safeguards fundamental rights and contributes to competitiveness and open strategic autonomy (Council of the European Union, 2023).

A proactive European framework on neurotechnology and human rights should blend legal safeguards with neuroethical principles, ensuring that innovation proceeds without sacrificing fundamental values. Based on the analysis above, the framework should be built around the core neurorights (cognitive liberty, mental privacy, mental integrity, and psychological continuity) and incorporate lessons from comparative experiences. This study proposes the following six key elements of such a framework.

5.1 Explicit recognition of cognitive liberty and mental privacy

The EU and the Council of Europe should consider formally acknowledging cognitive liberty and mental privacy in their human rights instruments or policy declarations. This could take the form of an additional protocol to the ECHR or a Council of Europe declaration stating that Article 8 (private life) and Article 9 (freedom of thought) include the protection of individuals against unwarranted neurotechnological intrusions into their thoughts. Similarly, at the EU level, an inter-institutional proclamation or an amendment to the Charter could be contemplated (though Charter amendment is complex). Without requiring a formal reform, the EU could integrate these concepts into legislation, for example, through delegated acts within the framework of the recent Artificial Intelligence Act (AI Act, Regulation [EU] 2024/1689). Although the AI Act does not explicitly mention neurotechnology, it could classify AI systems that use neurodata or interact with neuronal activity as either prohibited (Article 5) or high-risk (Article 6). These systems would require explicit informed consent, enhanced human oversight, and rigorous data protection. The aim would be to signal to all actors that practices such as non-consensual brain monitoring or coercive neuronal interventions are incompatible with European values. Such recognition would strengthen the protection of the *forum internum* against contemporary threats and support the individual's right to refuse neurotechnology. Indeed, an essential dimension of cognitive liberty is the individual's freedom not to use a BCI or neurotechnological enhancement if they do not wish to, without facing discrimination.

5.2 Strengthening data protection for neurodata

Building on the GDPR, the framework should clarify neurodata as a special sensitive category. European regulators could issue guidelines (through the European Data Protection Board) affirming that brain-derived

data, even if not overtly health data, typically fall under "biometric" or "health" categories given their nature. This would mean neurodata cannot be processed without explicit, informed consent or other very limited justifications. In addition, specific neurodata handling standards should be developed: for example, requiring encryption for brain data at rest and in transit (to prevent "brain hacking"), and stating that individuals have the right to access and delete their neural records (just as they do with personal data under GDPR), and perhaps even introducing a right to mental privacy by design. The latter could draw from privacy by design principles – neurotechnological devices and platforms should be built to minimise data collection (only necessary signals, processed locally when possible). Given the AEPD and EDPS's note that neurotechnology is "very intrusive, if not the most intrusive" form of data processing, high standards of proportionality should be enforced. For instance, if an employer in Europe wished to deploy attention-monitoring headbands on workers, data protection authorities should treat it as likely unlawful unless the most stringent conditions are met (true voluntariness, medical necessity, etc.). By codifying such guidance, Europe can indirectly ensure mental privacy, making it extremely difficult to lawfully collect or exploit brain data without the individual's freely given, specific, and informed consent.

5.3 Protecting mental integrity and psychological continuity in practice

These rights are admittedly more challenging to legislate because they deal with outcomes of interventions (harm to the mind or altering identity). However, Europe can take cues from existing biomedicine governance. One approach could be to extend the principles of the Oviedo Convention (Council of Europe, 1997) to neurotechnology. The Oviedo Convention – to which many Council of Europe states are party – already prohibits interventions aimed at modifying the human genome for non-health purposes (Article 13); a similar ethic could apply to neuro-interventions. For example, an amendment or a new protocol could declare that interventions by neurotechnology must have a therapeutic or benign purpose and require rigorous consent, thereby prohibiting uses that aim to modify a person's personality, emotions, or thoughts in a way that undermines their identity or welfare. In EU law, future amendments to the 2017 Medical Devices Regulation (MDR, Regulation [EU] 2017/745) or the recent AI Act could ensure that any medical or adaptive neurotechnology capable of altering mental states is assessed, not only for safety and efficacy, but also for ethical risks to the patient's psychological continuity. Additionally, criminal laws in EU Member States could be updated: non-consensual meddling with someone's brain (via unauthorised neurostimulation, say, or the misuse of neuromarketing to subconsciously influence consumers) could be criminalised akin to physical assault, or at least tightly regulated. This would underscore the notion that an individual's mental integrity is inviolable, and that deliberate actions to damage or control another's mind would be punishable with severe sanctions.

5.4 Ensuring fair access and preventing neuro-discrimination

A European neuroethical framework should include equity considerations. This can be done through policy rather than rights; for instance, EU research funding programmes (such as Horizon Europe) and health policies can promote universal access to beneficial neurotechnologies. If a BCI can restore speech to a paralysed patient, for example, such technology should not only be available to a wealthy elite. The EU could support Member States to include proven neurotechnological interventions in public healthcare coverage. Conversely, strong anti-discrimination rules should forbid employers, insurers, or governments from misusing neurodata. The EU already bans discrimination on disability and other grounds (Article 21 of the Charter), and this could be interpreted to cover discrimination based on brain data-derived inferences: for example, if a brain test suggests a propensity for depression, that cannot be used to deny someone a job, and such an action would be as unlawful as genetic discrimination. The AI Act already includes provisions on AI in employment and biometric analysis; it could be expanded in the future to include neurobiometric analysis, treating AI systems that interpret neural signals as "high risk" and subject to strict oversight.

5.5 Oversight and governance mechanisms

Rights and laws are only as effective as their enforcement. Therefore, a European neurorights approach should establish oversight mechanisms. One idea is a specialised neurotechnology oversight body at EU level – perhaps a branch of the European Data Protection Supervisor, or a multidisciplinary committee under the European Commission's ethics framework – tasked with monitoring developments in neurotechnology, issuing guidance, and reviewing high-risk applications. National ethics councils and data protection authorities should also build neurotechnology expertise. The framework could encourage the creation of ethics-by-design certifications for neurotechnology, just as the EU certifies data protection compliance or AI ethics assessments. International coordination is crucial too: the Council of Europe could coordinate with the OECD and UNESCO to develop guidelines for Member States to adopt, harmonising standards (the 2022 UNESCO call for a governance framework is a starting point). In courts, judges could receive neurorights training so that, when cases inevitably arise (e.g., a claimant alleging mental privacy violation), jurists can competently apply the new concepts.

5.6 Public awareness and consent culture

Finally, the ethical dimension requires fostering a culture that respects cognitive freedom. People should be educated about the capabilities and limits of neurotechnology so that they can give or withhold their consent from an informed position. Just as Europe led campaigns on data protection awareness in the post-GDPR landscape (European Data Protection Supervisor, 2024), it could now fund awareness on "mind privacy". Perhaps even a neuroethics impact assessment could be mandated for certain projects (in a similar way to environmental impact assessments), ensuring that the societal and ethical implications are transparently evaluated before a neurotechnology is widely deployed.

In proposing such a framework, it should be acknowledged that regulating emerging technology too heavily in the early stages could stifle innovation. Therefore, Europe should strike a balance that encourages the use of beneficial neurotechnology for health and education purposes, while foreclosing avenues of abuse that strike at human dignity. A phased approach could regulate the most sensitive uses (e.g., law enforcement use of BCIs, or consumer neuroadvertising) more strictly, while allowing medical research under oversight. The key is to embed neuroethical principles into the design and deployment phases of new technology, not wait for harm to occur. This echoes the Council of Europe's stance that human rights must be embedded from the outset in technological development (Council of Europe, 2020, April 8). If Europe succeeds in this, it can enjoy the benefits of neuro-innovation and set a global example for the humane governance of technology.

6 Conclusion

Neurotechnology offers extraordinary promise but also poses risks that current legal regimes only partly address. The present analysis has shown that, while European human rights law – through privacy, data protection, freedom of thought, and dignity provisions – provides a strong foundation, it was not explicitly crafted for the challenges of BCIs and neural data. Important values such as cognitive liberty, mental privacy, mental integrity, and psychological continuity risk being undermined if we fail to modernise our legal and ethical frameworks. Europe finds itself at a crossroads analogous to the early days of the internet or the advent of AI: legislative and policy choices made now will determine whether these technologies develop in a way that respects human autonomy and dignity.

In light of the foregoing discussion, this study recommends that the European institutions explicitly acknowledge neurorights in law, thereby signalling their importance and providing guidance to the Member States. For example, the EU could incorporate neurorights protections into forthcoming legislation. Moreover, the ECtHR and national courts could interpret existing rights dynamically in neurotechnology cases.

In conclusion, protecting the human mind is a defining challenge of our time. Europe's rich human rights tradition provides both an impetus and a framework to meet this challenge. By weaving together legal doctrine and neuroethical insight, we can craft a European approach that safeguards human dignity amid neurotechnological advancement. The comparative glance at Chile and others demonstrates that legal recognition of neurorights is not utopian, but rather feasible and potentially necessary. Europe has the opportunity to lead by example to ensure that, as we unlock the mysteries of the brain, we do not unwittingly disregard the very rights and liberties that make us human. It is time for policymakers, jurists, scientists, and ethicists to converge and future-proof our fundamental rights in the age of neurotechnology – securing not just our bodies, but also our minds, against intrusion and exploitation. In doing so, we uphold the essence of human autonomy: the freedom to think, to feel, and to be oneself, uncoerced and unmonitored, even in a world of ever more powerful machines.

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