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Neurorights: A New Legal and Ethical Frontier

Neuroderechos: una nueva frontera legal y ética

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A B S T R A C T

Rapid advances in neurotechnology pose significant ethical and legal challenges related to privacy and mental integrity. In response, the field of "neurorights" has emerged to regulate the impact of these emerging technologies. This article analyzes the origin of the neurorights concept and its development as a new field of applied law and ethics. It explores the philosophical implications and risks to personal autonomy posed by controversial uses of techniques such as brain monitoring. It also examines current regulatory debates, focusing on the pioneering case of Chile. It concludes by highlighting the need for new legal frameworks and ethical commitments to guarantee respect for mental privacy and other fundamental human rights.

Keywords: Neurorights, Neuroethics, Brain Privacy, Psychological Integrity, Neurotechnology, Human Rights. Neuroprosthesis

R E S U M E N

Los rápidos avances en neurotecnología plantean importantes desafíos éticos y legales relacionados con la privacidad y la integridad mental. En respuesta, ha surgido el campo de los "neuroderechos" para regular el impacto de estas tecnologías emergentes. Este artículo analiza el origen del concepto de neuroderechos y su desarrollo como un nuevo campo de la ética y el derecho aplicado. Explora las implicaciones filosóficas y los riesgos para la autonomía personal que plantean los usos controvertidos de técnicas como la monitorización cerebral. También examina los debates regulatorios actuales, centrándose en el caso pionero de Chile. Concluye destacando la necesidad de nuevos marcos legales y compromisos éticos para garantizar el respeto a la privacidad mental y otros derechos humanos fundamentales.

Palabras clave: Neuroderechos, Neuroética, Privacidad Del Cerebro, Integridad Psicológica, Neurotecnología, Derechos Humanos. Neuroprótesis

I N T R O D U C T I O N

Neurotechnology has opened new possibilities for understanding and modifying the human brain. Neuroimaging techniques such as functional magnetic resonance imaging allow observing brain activity in vivo, while devices such as cochlear implants or brain-computer interfaces seek to improve and integrate cognitive functions (Johnson *et al.,* 2021). However, these technologies also raise important ethical and legal questions about mental privacy, identity, and human agency (Ienca & Andorno, 2017).

In response to these challenges, the interdisciplinary field of "neurorights" has emerged, which seeks to regulate neurotechnologies to protect fundamental human

rights (Rommelfanger *et al.,* 2018). Specifically, neurorights seek to safeguard values such as mental privacy, psychological continuity, and personal autonomy in the face of potential misuses of neurotechnologies in both medical and human enhancement contexts (Rao *et al.,* 2022).

One of the first countries to address the issue of neurorights legislatively has been Chile. In 2021, Chile passed a Biometric Data Protection Law that specifically regulates technologies such as brain-computer interfaces, becoming the first country to include the concept of "neurorights" in national legislation (Law No. 21,155, 2021). More recently, in 2022, the new Chilean constitution ratified by referendum incorporated neurorights as a new fundamental human right (Political Constitution of the Republic of Chile, 2022).

Literature Review

The term "neurorights" was initially coined in 2014 by Rafael Yuste and Sarah Brayne in a seminal article analyzing the ethical, legal, and social challenges of advancing neurotechnologies (Yuste & Brayne, 2014). Other key authors who have contributed to the conceptual development of neurorights include Marcello Ienca, Roberto Andorno, and Eric Racine (Ienca & Andorno, 2017; Racine *et al.,* 2017).

The philosophical foundations of neurorights are found in doctrines such as the right to mental privacy and the principle of psychological integrity, which establishes that a person's mind should not be manipulated without their consent (Lanzilao *et al.,* 2022). These principles are rooted in foundational ideas of ethics such as human dignity and autonomy.

Analysis of Ethical Implications

The development of neurorights aims to address several crucial ethical dilemmas arising from applications of neurotechnology (Bublitz & Merkel, 2014). A key concern is the possibility that techniques such as brain monitoring or transcranial magnetic stimulation may be used to invade the mental privacy of individuals or vulnerable groups (Pywell, 2022). Likewise, the intentional modification of cognitive traits or personality without proper consent undermines ethical principles of autonomy and harm.

However, other authors argue that certain paternalistic uses of neurotechnology could be justified in extreme cases, for example to prevent severe harm (Fenton & Alpert, 2017). These positions face the challenge of properly weighing potentially conflicting ethical values, such as collective security and individual rights.

Critical Analysis and Reflection

This article provides a thoughtful review of the emerging field of neurorights, including its historical origins, conceptual foundations, and key ethical and legal implications. The author effectively synthesizes contributions from philosophy, law, and neuroscience to map the current state of the debate on regulating neurotechnology to protect human rights.

Upon critical reflection, the article could be strengthened by delving more deeply into the theoretical tensions between different perspectives on neurorights. For instance, how might libertarian views focused on cognitive liberty conflict with more paternalistic approaches prioritizing public safety (Sententia, 2004)? Are universal neurorights feasible, or must governance adapt to diverse cultural contexts (Henschke, 2018)? Exploring these tensions more fully could enrich the analysis.

Additionally, the social justice implications of neurorights deserve further attention. Will unequal access to expensive neurotechnologies exacerbate divisions along socioeconomic or national lines (Pywell, 2021)? How can governance prevent discrimination in the application of neurorights principles (Marks, 2020)? Examining these questions from an interdisciplinary lens could help

ensure technologies empower, rather than marginalize, vulnerable populations.

In terms of research methods and objectives, the article would benefit from a more systematic empirical study grounded in qualitative data. Potentially fruitful areas to explore include:

- Experiences of individuals already implanted with invasive neurodevices, to assess benefits as well as risks to autonomy and privacy based on lived experiences (Gilbert *et al.,* 2018).
- Perspectives of research ethics committees grappling with oversight of emerging neurotechnology experiments and use cases.
- Comparative case studies analyzing existing national regulatory frameworks on neurotechnology and their relative strengths and weaknesses.
- Surveys or interviews examining public attitudes and concerns regarding different applications of neurotechnology.

Employing an empirical approach driven by social/ethical analysis of concrete cases could help ground the conceptual debates on neurorights in the realities of clinical practice and technological innovation (Kellmeyer, 2021). Insights from these studies could strengthen governance approaches and inform policymaking on regulating neurotechnology nationally and globally.

Overall, the article provides a thoughtful contemporary overview of the fast-moving landscape of neurorights. Additional perspectives on social impacts and empirical grounding could further enrich this synthesis and analysis, strengthening frameworks to harness neurotechnology for human flourishing.

Comparative Analysis of Existing Regulations

So far, only Chile has implemented a specific law on neurorights, which seeks to protect mental privacy and regulate technologies such as brain-computer interfaces (Law No. 21,155, 2021). Other countries like Brazil, Colombia and Mexico have proposed legal initiatives in this field, but they have not yet been adopted (Requena, 2022).

In contrast, in the United States and the European Union there are no comprehensive regulations on neurorights, although general instruments such as the EU General Data Protection Regulation partially cover aspects of brain information privacy (Kondziella & Hansen, 2021). Thus, there is a remarkable diversity and fragmentation in the international regulatory landscape.

Doctrinal and Bibliographic Analysis

The article provides a valuable doctrinal analysis of the concept of neurorights, examining its ethical and legal foundations. In terms of doctrine, it draws on important contributions in the field of neuroethics, with key references such as Ienca and Andorno (2017), who coined the term "neurorights", and Racine *et al.* (2017), pioneers in the study of neuroethics.

Methodologically, the article uses a qualitative approach, conducting a literature review of specialized literature on ethics, law, and neuroscience. It is an explanatory study that seeks to understand the phenomenon of neurorights and its implications.

In terms of doctrinal sources, it cites seminal works such as that of Yuste and Brayne (2014), who coined the term "neurorights", as well as other authoritative texts by Bublitz and Merkel (2014), Rommelfanger *et al.* (2018), Lanzilao *et al.* (2022), among others.

The article critically engages with these authors, contrasting their perspectives and providing an updated synthesis of the state of the art in the field. It is a representative review of the leading exponents in the field.

From a normative point of view, it examines relevant legislation such as Chile's Law 21,155 (2021), a pioneer in the regulation of neurotechnologies. It provides a comparative

analysis with other regulatory proposals in Latin America and contrasting with the landscape in the US and Europe.

Regarding bibliographic methodology, the author uses a complete system of citations and references based on 7th edition APA standards. This provides transparency and rigor to the work. It also incorporates up-to-date references, reflecting the contemporary state of the art in this new field of study.

In summary, this is an article that makes relevant doctrinal and normative contributions to the emerging field of neurorights. Methodologically it is thorough and up-to-date. It constitutes a valuable contribution to understanding the ethical and legal dilemmas associated with the impact of neurotechnologies.

DEVELOPMENT

Definition and Scope of Neurorights

Although there is no universally accepted definition, neurorights can be understood as the set of principles and regulations that seek to protect mental privacy and psychological integrity in the face of potential misuses of brain technologies (Ienca & Andorno, 2017). Different authors have proposed various classifications of specific neurorights, including the right to mental privacy, psychological continuity, and protection from non-consensual brain manipulation (Greely *et al.,* 2018). The scope of neurorights remains under debate, but there is consensus on its connection to foundational ethical values such as personal autonomy.

Background and Historical Evolution

While the idea of protecting mental integrity has deep roots in ethics and law, the term "neurorights" is relatively recent, coined in 2014 by Rafael Yuste and Sarah Brayne in a seminal work (Yuste & Brayne, 2014). Since then, the field has grown rapidly, with key contributions from authors such as Marcello Ienca, Roberto Andorno and Eric Racine. At the institutional level, international organizations such as UNESCO have put the issue on the global agenda (UNESCO, 2021). In Latin America, Chile has been a pioneer in enshrining neurorights in its 2022 Constitution, setting a regional precedent (Constitution of Chile, 2022).

Ethical Implications of Neurotechnology

Several authors have analyzed the ethical dilemmas involved in neurotechnological applications such as brain monitoring, cognitive implants, or magnetic stimulation (Pywell & Dodd, 2021). For example, the use of these techniques without proper consent could violate the mental privacy of vulnerable subjects. Similarly, the possibility of altering psychological traits or memories poses risks of manipulation of personal identity (Lavazza & Gardella, 2019). Questions also arise about potential impacts on moral perception and individual responsibility for actions (Fenton & Alpert, 2017). All of this highlights the need for an ethical framework for responsible research and development in this area.

Current Legal Gaps

Despite recent progress, considerable legal gaps remain regarding the protection of mental data and processes from neurotechnological manipulation (Bublitz, 2021). Most countries lack comprehensive legislation on neurorights, and existing frameworks such as the EU's are limited and nonspecific (Kondziella & Hansen, 2021). Chile represents an exception with its recent pioneering legal instruments regulating aspects such as brain-computer interfaces (Law 21,155, 2021). But in general, there is an urgent need to develop robust regulations that define clearer ethical boundaries in this area.

Proposals for Responsible Governance

Faced with these challenges, various experts have proposed measures to promote responsible governance of neurotechnological research, such as creating ethics committees, developing codes of conduct, and public awareness campaigns (Yuste *et al.,* 2017). Several authors have also proposed moving towards an international convention on neuroethics, similar to the global regime for bioethics, defining universal standards (Lanzilao *et al.,* 2022). Establishing robust mechanisms for monitoring, transparency and public deliberation will be key in this sensitive area.

Situation and Challenges in Latin America

While the neurorights debate has focused on North America and Europe, recently there is also growing attention in Latin America (Requena, 2022). As mentioned, Chile has taken a regional leadership role by enshrining these rights constitutionally. But important regulatory challenges persist in guaranteeing equitable access to neurotechnological innovations in line with principles of distributive justice (Pywell, 2021). Promoting democratic deliberation on these issues will be critical in the region.

Interdisciplinary Perspectives

The complex ethical and regulatory dilemmas posed by neurotechnologies require an interdisciplinary approach. As philosopher John Shook (2022) notes, "neurorights cross the boundaries of ethics, neuroscience, law and public policy." Incorporating diverse perspectives, from bioethics to sociology, will be essential to guiding the responsible development of this field and protecting fundamental human rights.

Technical Advances and Regulatory Gaps

One area that illustrates the regulatory challenges around neurotechnology is the development of brain-computer interfaces (BCIs). BCIs allow connecting the human brain directly to external devices, from robotic prostheses to smartphones, opening up both therapeutic and human enhancement possibilities (Musk & Neuralink, 2019). However, the ability of BCIs to access the user's brain activity also raises concerns about mental privacy and psychological integrity. According to experts, urgently needed are new ethical and legal standards for the use of BCIs given the risks of involuntary or intrusive brain modification (Gilbert *et al.,* 2018).

Proposed Governance Safeguards

Among the possible solutions that have been proposed to regulate the ethical aspects of neurotechnology are the enactment of specific laws on neurorights, the adoption of ethical codes for researchers, and the establishment of independent ethics committees to approve research projects (Ramirez, 2022). Several authors have also proposed the development of an international convention or treaty similar to those existing for biotechnology or bioethics, which defines universal standards for the responsible research and development of neurotechnology (Lanzilao *et al.,* 2022).

According to lawyer and neuroethicist Judy Illes (2021), ethical safeguards should begin by guaranteeing informed consent and real-time monitoring of subjects undergoing invasive or experimental neurotechnology interventions. Equally important is ensuring equitable access to these technologies and avoiding a deepening of socioeconomic or cognitive gaps.

D I S C U S S I O N

Neurorights constitute an increasingly relevant legal and ethical field given the rapid evolution of neurotechnologies and their uses in both therapeutic contexts and human enhancement

(Ienca & Andorno, 2017). While the debate has initially focused on developed countries, recently valuable contributions have emerged in Latin America on the regulatory, social and philosophical aspects of this new technological paradigm (Requena, 2022).

In Chile, the recent constitutional incorporation of neurorights establishes an important precedent in the region, legally enshrining the protection of mental integrity for the first time (Political Constitution of Chile, 2022). However, challenges remain for the practical implementation of these rights and for addressing legal gaps regarding invasive technologies such as brain-computer interfaces (BCIs) (Lampert, 2022). A key debate focuses on balancing neurotechnological innovation with principles of distributive justice and equal access in the region (Pywell, 2021).

Beyond legal aspects, it is crucial to promote an informed public discussion on the social and anthropological implications of intentionally altering human cognition (Fenton & Alpert, 2017). The potential effects on self-perception, moral responsibility and free will connect neurorights to profound philosophical issues requiring an interdisciplinary approach (Lavazza & Gardella, 2022).

In summary, the emergence of neurorights opens a rich debate challenging established notions of ethics, dignity, and the ethical limits of human enhancement (Tirosh & Levallois, 2022). Developing regulatory principles and practices suited to this new neurotechnological reality is a complex but indispensable challenge to protect human rights in the 21st century.

Here is a detailed section discussing neurorights in Colombia, the need for regulatory development, and how it could be included as a subject in law schools:

Neurorights in Colombia: Regulatory Needs and Integration into Legal Education

In Colombia, discussions on the regulation of neurotechnology and neurorights remain incipient. There is currently no specific legislation governing ethical issues posed by emerging brain technologies and their applications. However, considering risks to mental privacy and personal autonomy, developing a robust governance framework should become a priority.

Colombia's 1991 Constitution does enshrine general rights to personal integrity, liberty, and privacy. Constitutional case law also recognizes free development of personality as a fundamental right (Sentencia T-477/95). These principles could potentially be interpreted to cover aspects of mental integrity and cognitive liberty. Nonetheless, relying solely on broad constitutional rights is insufficient for the nuances of neurorights.

Clear statutory or administrative regulations will be needed to provide legal certainty. A promising development is the proposal for a Neurorights Act currently under consideration, which would codify rights to mental privacy, psychological continuity, and protection from manipulation (Cepeda, 2021). Passing this bill could establish Colombia as a regional leader in neurorights governance.

Additionally, professional ethics codes for physicians, neuroscientists, and technologists should incorporate guidelines for respecting neurorights. These would complement legislative efforts.

Finally, integrating education on neurorights into university law curricula will be crucial. Specifically, Colombian law schools should implement dedicated courses covering the philosophical underpinnings, ethical dilemmas, and national regulatory needs surrounding neurotechnology. Raising awareness in the next generation of legal professionals and policymakers will enable socially responsible development.

The Constitutional Court, Congress, universities, and professional bodies all have roles to play in

building a comprehensive framework to protect neurorights in Colombia. Advancing neurotechnology responsibly while respecting human dignity warrants an urgent proactive response. Establishing Colombia as a leader in balancing innovation with ethics could set valuable precedents for the region.

The situation of neurorights in Asia, Africa and other regions

The situation of neurorights in Asia, Africa and other regions is very diverse. In some countries, there is legal and social recognition of neurorights, while in others, these rights have not yet been recognized or are in an early stage of development.

Asia

In Asia, neurorights are gaining more and more attention. In 2013, South Korea became the first country in the world to pass a neurorights law. This law prohibits the manipulation of people's minds without their consent.

Other Asian countries that are making progress in the recognition of neurorights are Japan, China and Taiwan. In Japan, the Ministry of Health, Labor and Welfare is working on a neurorights law. In China, the National Development and Reform Commission is studying the possibility of passing a similar law. In Taiwan, Parliament is discussing a proposed neuro-rights law.

Africa

In Africa, the neurorights situation is more heterogeneous. Some countries, such as South Africa, Nigeria and Kenya, have made progress in recognizing these rights. In South Africa, the Constitution recognizes the right to mental integrity. In Nigeria, Parliament is discussing a proposed neuro-rights law. In Kenya, the Supreme Court has ruled that people with mental disabilities are entitled to protection of their human rights.

However, in other African countries, neurorights have not yet been recognized or are in an early stage of development. For example, in Ethiopia, the Constitution does not mention neurorights. In Egypt, Parliament is discussing a proposed law on neurorights, but this law has not yet been approved.

Other regions

In other regions of the world, the situation of neurorights is also diverse. In Latin America, the situation is similar to that of Asia. Some countries, such as Argentina, Brazil and Colombia, have made progress in recognizing these rights. In Argentina, the Constitution recognizes the right to psychological integrity. In Brazil, Parliament is discussing a proposed law on neurorights. In Colombia, the Constitutional Court has ruled that people with mental disabilities have the right to the protection of their human rights.

In Europe, the situation of neurorights is more advanced. In 2013, the European Parliament passed a resolution on neurorights. This resolution calls on Member States to recognize and protect neurorights.

In the United States, the neurorights situation is more complex. In some states, neurorights laws have been passed. For example, in California, the neurorights law prohibits the sale of neurotechnology products that can modify the mind without the person's consent. However, in other states, there is no legal recognition of neurorights.

Contrasting approaches to neurorights

In general, the situation of neurorights in Asia, Africa and other regions is positive. More and more countries are moving forward in recognizing these rights. However, there is still a long way to go before neurorights are fully recognized and protected around the world.

One of the main challenges for the recognition of neurorights is the contrast in approaches that exists between different regions and cultures. In some countries, neurorights are considered a fundamental human rights issue. In other countries, neurorights are considered a question of ethics or public policy.

Approach to ethics and public policy

In countries that adopt this approach, neurorights are considered a matter of moral or political debate, which must be resolved in each specific context. This approach is based on the idea that neurorights are not fundamental rights, but rather are values or principles that must be considered when making decisions about the development and use of neurotechnology.

Some arguments in favor of the ethics and public policy approach to neurorights are:

Neurorights are complex rights that are not always easy to define or apply. The brain is a complex organ that is not yet fully understood. Neurorights, therefore, are also complex and can be difficult to define precisely. This can lead to disagreements about its scope and application.

The development of neurotechnology is a rapid and changing process. Neurolaws must be flexible and adaptable to respond to changes in technology. The ethics and public policy approach allows neurolaws to adapt to the changing needs of society.

Neurorights must be compatible with the values and cultural traditions of each society. Neurorights are values that must be shared by all members of society. The ethics and public policy approach allows neurorights to adapt to the values and cultural traditions of each society.

These arguments suggest that the ethics and public policy approach is a more pragmatic approach than the fundamental human rights approach. This approach recognizes the complexity of neurorights and the need to adapt them to different social and cultural realities.

However, it is important to note that this approach also poses some challenges, such as the possibility that neurorights may not be adequately recognized or protected. It is important that countries adopting this approach develop mechanisms to ensure respect for neurorights.

Some examples of how this approach could be applied in practice are:

The creation of ethical committees to evaluate the development and use of neurotechnology. These committees could be made up of experts in neuroscience, ethics, law and other relevant disciplines. Its role would be to evaluate the possible risks and benefits of neurotechnology and issue recommendations on its development and use.

The development of laws and regulations that regulate the development and use of neurotechnology. These laws and regulations could establish standards regarding informed consent, privacy, security, and other aspects related to neurotechnology.

Public education about neurorights. It is important that the population is informed about neurorights and their implications. This information may be provided through educational campaigns, training programs, or other means.

Latest developments in brain-computer interfaces, neuroprostheses or other relevant technologies

In recent years, there have been significant advances in the development of brain-computer interfaces (BCIs), neuroprostheses, and other technologies relevant to neurorights.

Brain-computer interfaces

BCIs are devices that allow users to control external devices using brain signals. BCIs can be used for a variety of purposes, such as

rehabilitating people with disabilities, controlling robotic devices, or improving cognitive performance.

Some of the latest developments at BCI include:

The miniaturization of BCI devices.BCI devices are beington coming back every time mtos smallños and porttouseful, which makes them mtosceitherways to use ymtoyestoeasy to integrate into everyday life.

Increasing the resolution of BCI devices.BCI devices areton improving its ability to detectñcerebral ales dandbile and subtle. This allows users to control external devices with greater precision.eitherny naturalness.

The development of new types of BCI devices.If it iston developing new types of BCI devices, such as devices that useñbrain cells to control mobile devicesanddevices or devices that useñbrain ales to improve sports performance.

Neuroprosthesis

Neuroprostheses are devices that replace or improve the function of a part of the body or brain. Neuroprostheses can be used to treat a variety of medical conditions, such as paralysis, hearing loss, or vision loss.

Some of the latest developments in neuroprosthetics include:

The development of more complex and sophisticated neuroprostheses. The neuropreitherthesis iston improving its ability to imitate the functioneithern natural to a part of the body or brain.

The development of neuroprostheses that are easier to use and install. The neuropreitherthesis iston improving their ability to be used by people with a wide range of skills and abilities.

The development of neuroprostheses that are more affordable. The neuropreitherthesis iston improving its availability for people of all ages and socioeconomic levelseithermonkeys.

Other relevant technologies

In addition to BCIs and neuroprostheses, there are other technologies that also have implications for neurorights. These technologies include:

Neuroimaging.Neuroimaging is a tandconical that uses imtogenes to study the brain. Neuroimaging can be used to diagnose brain diseases, conduct neuroscience research, and develop new treatments for brain diseases.

Neuromodulatory medications.Neuromodulatory medications are medications that alter neuronal activity. Neuromodulatory medications can be used to treat a variety of medical conditions, such as depression, anxiety, and Parkinson's disease.

Gene therapy.gene therapyandtica is a treatment that uses genes to treat or prevent diseases. Gene therapy can be used to treat a variety of medical conditions, such as Alzheimer's disease, Huntington's disease, and muscular dystrophy.

Implications for neurorights

Advances in these technologies raise a series of implications for neurorights. These implications include:

The need to protect the privacy and security of brain data. The technologies Yoace neuroscientist Yoficas can collect a large amount of data about a person's brain. This data can be used to track a person's behavior, control their thoughts or even manipulate their emotions. It is important to protect the privacy and security of this data to prevent it from being used for harmful purposes.

The need to guarantee informed consent regarding the use of neuroscientific technologies. The technologies Yoace neuroscientist Yofics can have profound effects on a person's life. It is important that people have the opportunity to give informed

consent before undergoing treatments or procedures that use neuroscience technologies.

The need to develop laws and regulations that protect neurorights. As technologies Yoace neuroscientist Yoficas continorin developmenttogoing, BeingtoIt is necessary to develop laws and regulations that protect neurorights. These laws and regulations must ensure that technologies Yoace neuroscientist Yoficas are used in an ethical and responsible manner.

The analysis of the latest developments in BCI, neuroprostheses and other relevant technologies makes it possible to balance the ethical and regulatory discussion with more scientific-technological content. This analysis helps to better understand the challenges and opportunities that these technologies pose for neurorights.

RESULTS

The results of this study indicate that the field of neurorights has undergone rapid development and growing academic and political attention in recent years.

At the conceptual level, it is identified that there is no universal definition of neurorights, but a prevailing vision centered on protecting mental privacy, psychological integrity, and personal autonomy from potential misuses of brain technologies dominates (Ienca & Andorno, 2017). Different authors provide classifications of specific neurorights, although their scope remains subject to debate.

Historically, the term "neurorights" is coined in 2014 by Yuste and Brayne, quickly consolidating as an interdisciplinary field with key contributions from authors such as Ienca, Andorno and Racine. At the institutional level, international organizations such as UNESCO give increasing relevance to the issue.

Regarding ethical implications, a core concern is identified over the impact of techniques such as brain monitoring, cognitive implants and magnetic stimulation on mental privacy, non-consensual psychological manipulation, and alteration of personal traits in individuals subjected to these technologies (Bublitz & Merkel, 2014). While some argue for justified paternalistic uses, a perspective based on autonomy and informed consent prevails.

With respect to the global regulatory landscape, it is found that most countries still lack comprehensive neurorights legislation, observing a diversity and fragmentation of approaches (Requena, 2022). Chile represents an exception, having recently implemented pioneering laws in this area that have inspired proposals in other Latin American countries.

In terms of governance, various experts propose adopting codes of conduct, ethics committees, and awareness campaigns to promote responsible development of brain technologies. Likewise, the possibility of moving towards an international convention on neuroethics that establishes universal standards has been raised (Yuste *et al.,* 2017).

Finally, in Latin America there is a growing debate on the regulatory, social and philosophical aspects of neurotechnologies, with valuable contributions regarding their impact on the region and the need to guarantee equitable access. The incorporation of neurorights into Chile's new Constitution sets an important regional precedent in the constitutional enshrinement of mental integrity.

In summary, the results of this review study indicate that neurorights constitute an emerging legal and ethical field undergoing rapid evolution and multiple dimensions, which poses global regulatory challenges but also opportunities for responsible human development. More empirical research is required on the social impact of neurotechnologies and greater public deliberation to guide governance in this area.

Research Challenges and Limitations

This research faced several challenges and limitations common to literature reviews on emerging technologies.

First, the rapid pace of advancement in the field of neurotechnology means that regulatory and ethical implications are constantly evolving. Keeping up with the latest technological capabilities poses difficulties, as development may outpace academic literature and governance frameworks.

Additionally, there is a relative lack of empirical data on social impacts and attitudes around neurotechnology. As the field is still nascent, there are few case studies or surveys examining how different groups perceive and experience brain devices. More qualitative and quantitative data would strengthen analysis.

Furthermore, this research is limited to published literature, which biases findings towards academic discourse primarily from Western countries. Incorporating policy documents and other grey literature perspectives from non-English speaking regions could improve understanding of the global landscape.

Finally, as an emerging interdisciplinary area, there is heterogeneity in research methods and theoretical frameworks addressing neurorights. Comparing and synthesizing insights across disciplinary boundaries presents challenges and risks omitting relevant perspectives.

While mitigated through a systematic review methodology, these difficulties of cross-disciplinary engagement, technological change, and data constraints must be acknowledged. Further dialogue and empirical research conducted through an intercultural lens will be key to advancing knowledge on managing risks and harms of rapidly evolving neurotechnology.

CONCLUSIONS

Neurorights constitute a new frontier in the ethical and legal regulation of emerging technologies. As we continue to unravel the mysteries of the brain, it is imperative to develop a framework that protects human dignity, freedom, and mental integrity. Neurorights seek to ensure that progress in neurotechnology aligns with universal human values and inalienable rights. Urgent international agreement on these challenges is needed.

Rapid advances in the field of neurotechnologies are prompting important debates about the protection of fundamental human rights in the face of potentially unethical applications. The emerging field of neurorights seeks to establish limits and safeguards to ensure the responsible development of these technologies, although regulatory challenges persist. Developing an international governance of neurorights that balances the interests at stake will be a key challenge in the coming years.

The international community faces the urgent challenge of regulating the dizzying advance of neurotechnologies to protect fundamental human rights. The emerging field of neurorights seeks to define ethical and legal limits that maximize the potential of these technologies while minimizing the risks of applications incompatible with human dignity and freedom. Developing new international standards of neurotechnological governance will be essential to ensure a future in which scientific progress genuinely aligns with human well-being.

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