

## Neurotechnologies and communication: Between brain connectivity and cognitive autonomy. The current debate toward regulation

*Neurotecnologías y comunicación: entre la conexión cerebral y la autonomía cognitiva. El debate actual hacia una regulación*

*Neurotecnologias e comunicação: entre a conexão cerebral e a autonomia cognitiva. O debate atual sobre a regulamentação*

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This text offers an analysis of the impact of neurotechnologies on communication, cognitive autonomy, and individual agency. Technologies based on brain-computer interfaces collect neural data that can alter a person's capacity for agency and potentially affect communication, this implies that the influence of a social structure is directly transferred to a technological device. Based on documentary research, and framed as a state-of-the-art review, the aim is to explore the shift in this paradigm regarding communication and individual agency, highlighting the consequent need for ethical and legal regulation in the emergence of neuro-rights.

**KEYWORDS:** Agency, digital identity, artificial intelligence, regulation, neurotechnology.

*El texto ofrece un análisis del impacto de las neurotecnologías en la comunicación, la autonomía cognitiva y la capacidad de agencia individual. Las tecnologías basadas en una interfaz cerebral recopilan datos neuronales que pueden alterar la capacidad de agencia de una persona y, potencialmente, la comunicación, esto implica que el paradigma de influencia de una estructura social se traslade directamente a un dispositivo tecnológico. A partir de investigación documental, y a manera de un estado de la cuestión, se pretende explorar el cambio de este paradigma en la comunicación y la capacidad de agencia de las personas, con la consecuente necesidad de una regulación ética y jurídica en la génesis de los neuroderechos.*

**PALABRAS CLAVE:** Agencia, identidad digital, inteligencia artificial, regulación, neurotecnología.

*O texto oferece uma análise do impacto das neurotecnologias na comunicação, na autonomia cognitiva e na capacidade de ação individual. As tecnologias baseadas em uma interface cerebral coletam dados neuronais que podem alterar a capacidade de ação de uma pessoa e, potencialmente, a comunicação, o que implica que o paradigma de influência de uma estrutura social seja transferido diretamente para um dispositivo tecnológico. A partir de uma pesquisa documental e como um estado da questão, pretende-se explorar a mudança desse paradigma na comunicação e na capacidade de ação das pessoas, com a consequente necessidade de uma regulamentação ética e jurídica na gênese dos neurodireitos.*

**PALAVRAS-CHAVE:** Agência, identidade digital, inteligência artificial, regulamentação, neurotecnologia.

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## INTRODUCTION

Technological advances have profoundly transformed communication and human interaction, particularly with neurotechnologies. This concept refers to a variety of methods and instruments that interact with the brain and the nervous system in general, both passively –monitoring– and actively –altering brain activity (Andorno, 2023, p. 17). Although these technologies have medical applications, their impact has contributed to the development of communication instruments (Andorno, 2023). This document examines the development of neurotechnologies and their repercussions on individual agency.

The emergence of devices connected to brain activity introduces an innovative paradigm that directly affects the processes of receiving, transmitting, and elaborating information, raising concerns about the potential manipulation of thought and emotions due to their capacity to do so through external or internal stimuli.

The ability of neurotechnologies to access and modify neural data constitutes a significant challenge to personal autonomy and free expression. In this sense, interaction ceases to be exclusively unidirectional and adopts a bidirectional dynamic, which can affect identity and authenticity in interpersonal communication.

Furthermore, this work addresses the convergence between the human body and technology, highlighting the need to update the current legal and ethical framework. It presents the progressive evolution of human rights, from basic freedoms to social and collective rights, emphasizing the emergence of a new generation of rights: digital rights and, particularly, neurorights. These aim to protect personal identity, mental privacy, free will, and to mitigate the impact of algorithmic bias, fundamental aspects for communication and the perception of reality in the digital era.

Through risk assessment and benefits associated with these technologies and considering international legislative responses, the importance of establishing regulations that promote the ethical and legal use of neurotechnologies is emphasized. Such regulation is essential to ensure that scientific advances legitimately contribute to collective well-being, without undermining individual agency or the basic principles of social and communicative interaction in a globalized context.

### *Agency and neural data*

In the field of social sciences, understanding how individuals act and generate meaning has been a predominant concern in sociology, with authors such as Weber (2002) and Bourdieu (2007), who laid the foundations for understanding social action. Even mathematically, in game theory, rationality has been measured (Bunge, 2009, pp. 381, 389). These perspectives have allowed recognition of the interaction between structure and social action. Agency is manifested in the capacity of individuals to produce and reproduce discourses within a specific field (Giovine & Barri, 2024).

Recent technological advances are changing the paradigm from which agency is produced. With neuronal mediation between thoughts and agency, a disciplinary tension arises in communication studies regarding whether technology mediates message creation –how is the responsibility of the sender determined? The risk of algorithms that modify or anticipate intentions affects public discourse, cooperation, free expression, or informed consent. In this sense, the field of communication must incorporate questions about willingness, transparency, authenticity, and normative regulation, both from theoretical-critical approaches and from institutional media practices.

Technological devices connected and communicating with brain activity influence how people process, transmit, and receive information. This raises ethical and legal challenges because neural data allow access to a person's thoughts and emotions, compromising autonomy and the ability to express oneself freely. Specifically, data arranged and ordered in algorithms “guess the intention of the action and complete it” (Yuste, 2019, p. 26); in sum, altering a person's agency. As Villareal Durán suggests (2024), algorithms become instruments for structuring people's life worlds “reflected in productive, financial, communication-al processes, ... [affecting] forms of participation, representation, and deliberation in democracies” (p. 1).

For Chandler et al. (2021), the development of brain-computer interfaces introduces a new paradigm, a two-way neurotechnological communication. These systems generate direct channels between neural intentions and expressed content, which raises extreme scenarios for judging the voluntariness and accuracy of communication that is decoded (Chandler et al., 2021).

Since the 1960s, medical advances have led to the study of how the brain responds to common external stimuli, such as sound and light, as well as situations like physical activity and stress. Although the objectives, beyond medical diagnosis, were to understand brain function and establish causal relationships, in the current landscape, recent technologies based on this understanding of the brain allow the design of stimuli that provoke an expected response.

Some media have been interested in how to attract audience attention to successfully deliver a message (Barrientos-Báez et al., 2025, p. 5). Neuroscience, together with communication or marketing, employs biometric sensors, such as eye tracking, magnetic resonance imaging or electroencephalograms to decipher viewers' brain processes in response to audiovisual stimuli (Barrientos-Báez et al., 2025; Monasterio et al., 2019).

The data collected can be used to design actions for predictability and understanding audience behavior. Practically, by collecting neural data through brain activity, it is possible to “edit” them, not by implanting them, but by exposing individuals to a “designed” stimulus –as already occurs, for example, with electrical stimuli that certain prostheses emit to a muscle to provoke movement. An emerging discipline, neurocommunication, uses knowledge about brain processes of perception, attention, emotion, and reward to understand the habitual stimuli of social networks, designed to be highly attractive and gratifying, impacting behavior and perception of reality (Caldevilla-Domínguez, 2023).

This poses the risk of affecting communication by influencing persuasion, manipulation, and decision-making, given the possibility of brain stimulation or brain-computer interfaces, even with feedback algorithms to influence cognitive processes without the individual being fully aware. In this sense, there is growing scientific and legal interest in ensuring that neurotechnologies are used ethically and with respect for human rights (Beloso Benito, 2023; Ríos, 2023). From the perspective of neurocommunication, attention is focused on how messages reaching the brain are modulated. If neurotechnologies allow access to or modification of mental states, then communication ceases to be a free process. This poses a direct threat to cognitive autonomy, a fundamental ethical principle.

It is necessary to raise ethical questions about the use of new technologies, which, while advancing health, can also pose social risks. Therefore, the emergence of human rights and their adaptation to social, political, and even technological changes will be analyzed, leading to a context where it is necessary to propose new rights, such as digital rights –already implemented– and now neurorights.

### *The technological milestone in rights*

According to Ferrajoli (2006), a theoretical definition of human rights is that they are positive expectations (of benefits) or negative expectations (of not suffering harm) attributed to a subject by a legal norm (p. 37). This definition does not detail the content of rights or define what a right should be; for example, the protection of life is a right, as is the requirement for authorities to follow legal procedures –a right to legal security.

In the first instance, human rights emerged to protect the person, that is, as a negative expectation not to suffer harm to life or body, later extending to property rights. Then, it became necessary to consider the context in which people live, so protection rights were insufficient, and conditions had to be considered; hence, other types of rights emerged, such as the right to food or health. Soon, other rights became necessary, such as protection against labor exploitation: fair wages or the eight-hour workday.

This same trajectory of what human rights are should be explained by the milestones in which they were conceived. The liberal revolutions gave rise to rights of freedom, and social revolutions consolidated rights of equality and social rights. These are considered first- and second-generation rights. The persecution of groups and the destruction of ecosystems led to third-generation rights, those of peoples, collectives and environmental.

Currently, there is a new generation of human rights, indicated as fourth generation, related to recent technologies. These also require non-injury or provision, such as the right to exist digitally or the right to digital identity. According to Morales (2018), the convergence of various facets of a person's life immersed in information technology generates two major areas:

The first group encompasses all prerogatives emerging from the scenario of new communication and information technologies in cyberspace, which also require regulation in terms of duties and rights. Another subgroup refers to rights related to a new legal status for human life because of the development of new biomedical technologies, which affect their preservation, extension, and production (p. 43).

In this context of advancing human rights, Dias et al. (2025) address and contribute to the debate on the regulation of neurorights as new human rights, aiming to protect rights not yet protected or sufficiently guaranteed in the current international regulatory framework; for example, rights to privacy and intimacy. As the authors note, regulating neurotechnologies will help strengthen efforts to pass stronger privacy laws and policies. In this sense, “traditional” rights of the last three generations are affected in technological contexts, leading to new rights and obligations, even new sanctions according to the context. The other area, described by Morales Aguilera (2018), is that a new identity personality develops from this condition, giving rise to demands for digital rights.

The right to Internet access, to digital identity, or to be forgotten are increasingly recurrent. The right to digital identity relates to aspects inherent to a person: image, voice or biometric data, making their existence on the network possible. Similarly, the right to be forgotten became necessary when computer databases maintained real-time and sustained details about a person’s life, combining with privacy rights and relating to others, such as the right to protection of personal or sensitive data, the self-determination of information that grants freedom for the rights holder to decide the course of their digital identity, that is, informational self-determination.

The “traditional” rights undergo digitalization, meaning people exercise part of their lives in a “digital world” (Riofrío Martínez-Villalba, 2014), where metaverses are also built (Kumar, 2024) to offer and create products, services, and content designed for users; these digital worlds are “interactive and fully immersive, transcending the boundaries of physical and virtual reality” (p. 1), where the subject’s agency is circumscribed by what they perceive and do in that world.

In this same line, Nikolau et al. (2022) present an interesting analysis of changing social attitudes in virtual reality environments, which may offer clues to understanding subjects' agency, particularly if we start from Oskamp and Shultz's definition (as cited in Nikolau et al., 2022) of attitude as "a summary of all evaluative beliefs/opinions a person has about an attitude object, their affective reactions to it, and their behavioral responses" (p. 31). These attitudes reflect opinions and value judgments, preferences, and conditioned rejections, manifested in the "virtual worlds" where interaction occurs.

Therefore, according to García Díaz (2021), it is necessary to analyze the relationship of neuromodulation for the improvement of moral agency, especially from rational and deliberative dimensions that explain the degree of autonomy with which a subject makes decisions and interacts in both digital and physical worlds.

In the same way, the digital world, as Riofrío Martínez-Villalba (2014) notes, is a world of exposure; every byte of information circulating on the Internet is directly or indirectly attributable to a physical person. Exposed information is highly likely to circulate freely due to its interconnection. The digital world is a reflection: "the virtual world is caused by the real world: without the real world, there is no virtual world. The digital is a reflection of the analog" (p. 21).

Moreover, the digital world does not exist in physical space; therefore, time is relative, and information circulates at the speed of light, without physical borders or schedules. It is a space of expanded freedom and responsibility, without legal, ethical, or moral limits, and a space of relative equality, where some have more power than others (Riofrío Martínez-Villalba, 2014).

Digital rights occur in different communicative contexts that are often in constant tension: truth and falsehood; exposure and privacy; profit and free; mere information and other service contexts; common and specialized (Riofrío Martínez-Villalba, 2014). Globally, according to Global Web Index 2025, 67.9 % of the world population, 5.56 billion, use the Internet; 2.5 % more than in 2024 (Kemp, 2025).

A figure close to that of Internet users is that of user identities, with about 5.24 billion registered, that is, 63.9 % of the world population, considering only social network users. These identities allow users to

access applications ranging from passwords to personal and biometric data for identification (Kemp, 2025). This suggests the magnitude of “digital identity”; most Internet users have an account for identification. Nevertheless, despite these figures, inequalities in infrastructure and Internet inclusion persist in regions and localities, mostly in Africa.

Therefore, it can be inferred that a large part of the population is interconnected. The information we disseminate does not only come from the legitimate right of expression, because the development of new technologies makes it easier to collect information that makes us identifiable, such as biometric data.<sup>2</sup>

According to the National Institute for Transparency, Access to Information, and Protection of Personal Data (Instituto Nacional de Transparencia, Acceso a la Información y Protección de Datos Personales-INAI, 2018), biometric data are “physical, physiological, behavioral properties or personality traits attributable to a single person and measurable” (p. 10); these are universal, unique and permanent. These typical physical or physiological properties are fingerprints, face (facial recognition), retina, iris, hand or finger geometry, hand vein structure, ear shape, skin or dermal texture, DNA, chemical composition of body odor, vascular pattern and heart rate (INAI, 2018). In turn, typical behavioral and personality traits are autograph signature, handwriting, voice, keyboard pressing style, and gait (INAI, 2018, pp. 10-11).

These physical, physiological and behavioral properties or personality traits can be accessed more or less immediately, recorded, stored and measured, so that, by analyzing a pattern, a sequence is obtained, that is, an algorithm that makes a person identifiable. These biometric data are already used, for example, to access electronic devices, conduct banking transactions, or file taxes, using fingerprints, voice, or facial features. However, all these data obtained directly from people do not cause direct manipulation of their personality.

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<sup>2</sup> In the case of Mexico, they were already applied for tax administration services, but now their scope is being extended to the majority of the population, through the official identity document (CURP), which was published by decree on June 16 in the Official Gazette of the Federation and came into force in January 2026.

### *Ethical considerations and neurorights*

Recent technologies converge on biometric data, even including neural network data. Neuroscience studies the entire nervous system, how the brain, spinal cord, and networks of sensory or motor nerve cells, called neurons, interact (National Institute of Child Health and Human Development [NICHD], 2019). Nerve cells communicate via electrical impulses that stimulate a chemical substance called a neurotransmitter (Mayo Clinic, 2024; NICHD, 2019). This behavior, obtained as data, is measurable and thus susceptible to digitization in a device (Ausín et al., 2021; Bastidas Cid, 2022).

With the study of this interaction, the medical field of bioelectronics emerged; by understanding how messages travel from the brain to different body parts, applied science developed neurotechnology. This involves developing “any tool or technique capable of manipulating, recording, measuring, and obtaining information from the brain” (Ausín et al., 2020, p. 1). This advance has been developed for treating paralysis, neurological disorders, and mental illnesses –even depression– effectively. However, like many medical advances, ethical questions arise.

Neural data obtained from non-invasive devices can be used for marketing purposes “by detecting signals related to our preferences and dislikes” (Ramos, 2023, n.p.). Ethical concerns revolve around the influence on thought and emotions that could affect democracies and the foundations of society. They can also deepen inequality if access to this technology is limited to a social group, potentially leading to “social tensions and conflicts” (Ramos, 2023, n.p.).

In this sense, neurotechnology carries the latent risk of accessing and manipulating brain structure, known as neuromodulation –the alteration of nervous activity by applying electrical stimuli (Ausín et al., 2020). With the development of artificial intelligence in the clinical field, it can predict neuropsychiatric pathologies; machines trained by AI can “detect early biomarkers of Alzheimer’s disease and other mental illnesses from functional magnetic resonance imaging” (p. 1).

Nevertheless, neurotechnologies, together with artificial intelligence, “can easily become a threat to notions of human identity, human dignity, freedom of thought, autonomy, (mental) privacy, and well-being” (Ramos, 2023, n.p.). In recent years, two experiences have served

as starting points to exemplify the dangers of algorithmic bias using data collected from users' interaction in the digital world of social networks: the election for President of the United States in 2016, and the United Kingdom's referendum to leave the European Union (Bastidas Cid, 2022; Saura García, 2023).

Until now, our interaction with devices had been unidirectional, with devices receiving orders. In contrast, with neurotechnology development, the relationship is bidirectional: technological devices can "edit us", causing cognitive biases due to exposure to certain information deliberately produced for a specific effect (Colina, 2023), consequently manipulating agency.

A person's body becomes a kind of electronic platform, a sort of "Internet of Bodies" (Ausín et al., 2020, p. 2). While social structures influencing agency persist, the possibility arises to directly intervene in people's actions by manipulating the brain.

Companies such as Meta (Mark Zuckerberg) and Neuralink (Elon Musk) have allocated specific resources to create technologies capable of identifying, decoding, and reinterpreting brain activity, so far dedicated to the medical field. Meta is developing a neural interface, a device that "allows users to control digital devices through nerve signals detected in the wrist" (Asociación Club de Inventores Españoles, 2024, n.p.). Neuralink, meanwhile, is developing a "brain-computer interface" for people with quadriplegia (Neuralink, 2025, n.p.).

Mediation with neurotechnology and the body has taken another step with interaction between people. As reviewed by Gutiérrez and Díaz (2023), social cognition functions –that is, the capacity to form bonds, make social decisions, communicate, and empathize– can be influenced. Empirical studies reviewed by these authors have recorded how brain activity increases when more people communicate with each other, even using a technological interface between two brains, achieving cooperative tasks with a "visuomotor" link and creating a "social network" between brains. The research by Eckstein et al. (2012, as cited in Gutiérrez & Díaz, 2023, p. 51) demonstrated that combining the neural activity of several brains not only improves accuracy but also produces "great time savings" in decision-making.

Of course, neurotechnology helps treat and prevent diseases, but it also problematizes debatable aspects such as identity, authenticity, and autonomy. As Goering et al. (2021) emphasize, agency is central to the full exercise of these elements, since both subjects and technological devices participate in a kind of co-agency or collaborative shared agency, and one must also add the interaction that occurs between people mediated by neural devices or interfaces.

### *Neurorights as a sphere of protection*

Under these circumstances, it is necessary to advance toward a legal system that regulates the convergence between the human body and these technologies. According to De Asís (2022), the term “neuroright” was coined by Sherrod Taylor in the early 1990s to refer to the collaboration between neuropsychologists and lawyers. Subsequently, the field expanded to cover the intersection between neuroscience and law, with topics such as cognitive enhancement, the neuroscience of free will, the ethics of neuroimaging, and neuroscientific evidence in courts.

The legal framework must incorporate this new milestone in the genesis of rights, as the treatment of brain data presents significant ethical and legal challenges. It requires examination of the ethical correctness of treatment, enhancement, invasion, or manipulation of the human brain as a communication platform, informed consent, and the precautionary principle, among others. The objective of this legislation in the field of human rights is to protect mental states from technologically possible, non-consensual intrusions and manipulations.

Key concerns such as identity, privacy, free will, and bias in the use of neurotechnologies –as is currently the case with the use of artificial intelligence– are aspects to consider when formulating “neurorights”. A basis for initiating this discussion is what Ausín et al. (2020, p. 6) point out as influencing the following:

1. *The right to personal identity*: to protect one’s physical and mental integrity against changes that could be induced by technologies connected to the brain.

2. *The right to agency*: to maintain freedom of thought and free will to choose one's own actions without undue influence from technologies that may alter these processes.
3. *The right to mental privacy*: to preserve the ability to keep thoughts and the mind free from unauthorized intrusion and disclosure.
4. *The right to equitable access to mental enhancements*: ensuring that the benefits of improvements in sensory and mental capacity through neurotechnology are distributed fairly and equitably.
5. *The right to protection against algorithmic bias*: ensuring that technologies do not introduce prejudices that may influence cognition and people's decisions.

The above serves as a starting point for national legislation that can offer not only recognition of the right but also the design of a mechanism that makes it possible to guarantee these rights due to the disruptive potential to people's agency.

In 2020, Chile presented a bill on neural rights, which in 2021 resulted in a constitutional reform to safeguard "brain activity" and the information derived from it (Vásquez, 2022). Furthermore, based on this reform, in August 2023, the Third Chamber of the Supreme Court of Chile issued an important ruling for the protection of psychic integrity in the use of a device that collects information from the brain's electrical activity. Among other points, it highlighted the absence of legislation and the urgency of attention:

Special attention and care must be given in its review by the State, in order to prevent and anticipate its possible effects, as well as to directly protect human integrity in its entirety, which includes privacy and confidentiality and the rights inherent to psychic integrity and the subject of scientific experimentation (Tercera Sala de la Corte Suprema de Chile, 2023, p. 12).

In Brazil, in 2022, a reform was proposed to include neural data as sensitive information (Câmara dos Deputados, 2024). At the same time, in Argentina, a legislative debate began on the treatment of brain data as evidence in criminal proceedings (Andorno, 2023). In April 2024, the state of Colorado, United States, issued a reform to the Privacy Act

to protect biological and neural data generated by the brain (Moens, 2024). In this reform, Jared Genser, part of the scientific group promoting the measure, stated that “what we think and feel, as well as the ability to decode it from the human brain, is among the most invasive or personal things for us” (as cited in Moens, 2024, n.p.).

Other regional organizations that have considered neurorights are: the Inter-American Juridical Committee, an advisory body of the Organization of American States (OAS); the Latin American and Caribbean Parliament (Parlatino); the International Bioethics Committee (IBC) of Unesco; and the Organization for Economic Cooperation and Development (OECD) (Andorno, 2023). For its part, the United Nations Human Rights Council (2022) approved the Resolution on “Neurotechnologies and Human Rights”, recognizing that neurotechnologies can “access, monitor, and manipulate the human nervous system” (p. 1).

In 2024, Unesco addressed the need for ethical regulation at its 42nd General Conference, whose draft recommendation was presented at the end of 2025. It urges States to ensure equitable use of neurotechnologies and the adoption of regulatory frameworks (Unesco, 2024).

The debate in Mexico on this topic is recent. Since 2024, forums have been organized with the participation of legislators, academics, and specialists. These initial efforts recognize the importance of neurorights as a necessary evolution to be incorporated into the catalog of human rights, with the aim of addressing the complex intersections between technology, ethics, and privacy in the era of neurotechnologies.

## CONCLUSION

The integration of neurotechnologies into communicative processes represents a transformation in the way individuals interact, comprehend, and make decisions. Neural interfaces gather more information directly from the brain, and not just the biometric data that until now made us identifiable, but this data could be “editable”. This opens a window for clinical intervention to alleviate certain diseases and conditions. However, it also introduces ethical risks related to cognitive manipulation, the loss of mental privacy, and the violation of individual autonomy. These represent social and political risks if ethical and re-

sponsible scrutiny of their application and informed consent are not ensured, in order to validate the voluntariness and transparency of the sender.

Private companies are developing devices that interconnect neural signals and collect this data. This creates opportunities for medical purposes or other activities in which the user may not have control over their own data. Consequently, communication ceases to be a free and spontaneous act, becoming a space potentially intervened by systems capable of influencing thought. Therefore, it is necessary to establish ethical and legal frameworks to regulate the use of these technologies, recognizing the need to protect neurorights as an extension of human rights in the digital and neuroscientific era. The interest in developing legislation and ethical principles is already beginning to shape a protective framework; some experiences have resorted to data protection as supplementary legislative measures to determine the legitimate use of neural data.

Human rights are the sphere of protection against external forces, whether State or non-State agents. Rights entail the obligation of authorities to provide benefits that enable a dignified life. These rights evolve as milestones occur, such as liberal and social revolutions, as well as advances in new technologies that allow for a person's digital existence or their capacity for agency in both the digital and analog worlds.

This documentary approach highlights the relevance of addressing a global debate regarding advances in neurotechnology. These developments have accelerated since the beginning of the millennium and have advanced rapidly in a short period. Moreover, with the implications this entails for the agency and social action capacity of individuals who have adapted to and adopted these rapid changes. Consequently, institutional efforts are now focused on building a normative framework for global governance to protect human rights and fundamental freedoms.

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