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| Human Rights Council Advisory CommitteeQuestionnaire on “Neurotechnology and human rights”  |

Background

In accordance with Human Rights Council [resolution 51/3](https://undocs.org/A/HRC/RES/51/3), the Advisory Committee is preparing a study “on the impact, opportunities and challenges of neurotechnology with regard to the promotion and protection of all human rights” to be presented to the Council at its fifty-seventh session (September 2024). In the preparation of this study, the Advisory Committee was asked “to seek the views and inputs from, and to take into account the relevant work already done by, stakeholders, including Member States, international and regional organizations, the Office of the United Nations High Commissioner for Human Rights, the special procedures of the Human Rights Council, the treaty bodies, other relevant United Nations agencies, funds and programmes within their respective mandates, national human rights institutions, civil society, the private sector, medical and technical communities, academic institutions and other relevant stakeholders”.

Neurotechnologies are defined for the purposes of this study, as those devices and procedures used to access, monitor, investigate, assess, manipulate and/or emulate the structure and function of the neural systems of natural persons.[1] They are meant to either record signals from the brain and “translate” them into technical control commands, or to manipulate brain activity by applying electrical or optical stimuli.[2]

Deadline

Responses to the questionnaire can be submitted until 2 July 2023. Nonetheless, on exceptional basis, late responses or further information relevant to the work of the Advisory Committee on this topic may be accepted.

Questionnaire

Please answer the questions that are most relevant to your field of expertise or operation. There is no need to answer questions that may not be relevant to your work. Please respond as succinctly as possible and provide examples and substantive information where possible.

DISCLAIMER: This is not an official position from IEEE or any of its societies, associations, or tech communities.

QUESTIONS

I. All stakeholders (core questions)

*General*

1. Has your country taken any policy action or initiative in relation to neurotechnology and human rights at the national level? If so, please share any relevant information.

2. Is there any actor in the public or private sector developing this kind of technology in your country? Please provide information, if possible.

3. Indicate your level of awareness (high/medium/low) in relation to the state of development of neurotechnologies and preparedness to tackle the challenges posed by the early commercialization of these technologies.

We are a group of people with a medium-high level of awareness in relation to the state of development of neurotechnology.

Contributors to this response are individuals who participate in a voluntary basis to two working groups of the Institute of Electrical Electronic Engineers (IEEE) that are related to Neuroscience and Neurotechnology: The IEEE Brain Neuroethics Subcommittee and IEEE Standards Association (IEEE SA) P7700 Working group.

IEEE is the world’s largest technical professional organization dedicated to advancing technology for the benefit of humanity. The IEEE Brain Technical Community is an IEEE-wide effort, uniting engineering and computing expertise across IEEE Societies and Councils relevant to neuroscience and other disciplines. It provides an avenue for IEEE to work with multiple constituencies in academia, industry, and government interested in incubating and sponsoring new activities, projects, and standards that facilitate ethical and responsible neurotechnology commercialization. IEEE Brain started as an IEEE Initiative in 2015, and it transitioned to a Technical Community in 2021.

The IEEE SA P7700 Working group, is the first IEEE socio-technical standard with a focus on neurotechnologies. It is part of the IEEE initiative on Ethically aligned design that has already launched several initiatives for standardization of autonomous and intelligent systems..

Please note that our response to this questionnaire includes the personal opinions of the people listed as contributors at the end of this document, and it does not constitute an official statement from IEEE, or any other organizations with which these individuals are affiliated.

*Impact, opportunities and challenges*

4. What human rights will be mostly impacted by the development and use of neurotechnologies? Identify the three rights most impacted and briefly explain why.

Article 3: Everyone has the right to life, liberty and the security of person: Authorized and unauthorized access to quantitative data about human brain structure, activity and function (also known as neurodata) could threaten an individual’s right to liberty and security through improper or breached data storage and (free or monetised) sharing, including scenarios meeting informed consent standards for involved stakeholders. Moreover, the use of neurotechnologies in different areas of application raises considerations regarding user’s right to liberty and security. For example, in the case of brain implants, in the event these were hacked these could threaten the user’s bodily integrity and potentially be a threat to this person’s security.

Article 7: All people are equal before the law and are entitled without any discrimination to equal protection of the law. All are entitled to equal protection against any discrimination in violation of this Declaration and against any incitement to such discrimination: Right to Non-discrimination: Neurotechnologies can pose a risk of discrimination against individuals based on their neural characteristics or mental conditions. As these technologies advance, there is a potential for misuse by persons or organisations in power positions, leading to discriminatory practices. For example, employers or insurance companies could exploit neurodata to discriminate against individuals with certain neural profiles or mental health conditions, thereby denying them opportunities or services. Protecting the right to non-discrimination is essential to ensure fair treatment and equal opportunities for all, regardless of their neurological attributes.

Article 18: Everyone has the right to freedom of thought, conscience and religion: Unauthorized access to an individual’s real-time or recorded neuro-data which can be then decoded/translated into human-readable information would violate Article 18. Here is important to stress that the right of freedom of thought can be threatened even if neurotechnologies are not able to accurately decode information from brain signals. There are multiple precedents of systems using unreliable evidence to suppress ideas (ranging from witch-hunting a few centuries ago to efforts to establish predictive policing or social scoring). Development of neurotechnologies should envision effective ways to implement meaningful informed consent to accessing information derived from neurodata, and mechanisms for allowing users to prevent access by non-authorized parties. Protecting these rights is crucial in order to safeguard individual autonomy, and maintain bodily autonomy.

5. What are the biggest challenges and risks that the development, test and use of neurotechnologies pose to human rights? Will such risks be amplified by the development of consumer-oriented neurotechnologies?

Lack of comprehensive governance frameworks: The multiplicity of application fields of neurotechnologies, including medical, consumer and military technology, may result in diverse, heterogeneous governance and regulatory frameworks for each domain. Creating the possibility of system developed within poorly regulated frameworks being be repurposed for riskier applications. Hence coherent safeguards across fields are necessary for ensuring protection of human safety and dignity even in cases of dual use of neurotechnologies

Right to Access: The development, testing, and use of neurotechnologies present significant challenges to guarantee the right to equitable access, to benefit of the potential positive impacts of these technologies, in particular considering the existing digital divide and sociodemographic factors. While advancements in neurotechnology have the potential to greatly benefit individuals, the availability and affordability of these technologies can create a disparity between those who can access them and those who cannot. Lack of access to neurotechnology-based solutions such as assistive technologies, brain-controlled prosthetics or tools for cognitive training, can further exacerbate existing inequalities, leaving marginalized or under-served and under-represented populations at a disadvantage when it comes to receiving the benefits of neurotechnologies. Moreover, social and economic factors can play a role in determining who has access to these technologies. Disparities in income, education, and healthcare resources, for instances may limit the reach of neurotechnologies, making them inaccessible to marginalised communities. To address these challenges requires collaborative efforts between technology developers, policymakers, and communities to establish affordable pricing models, improve infrastructure, and provide adequate training and support to enable widespread and equitable access to these transformative technologies.

Right to Privacy: Neurotechnologies, such as brain-computer interfaces (BCIs) and neuroimaging techniques, can potentially be used to infer the person's mental states and activity, such as thoughts and emotions. This unprecedented level of access raises concerns regarding the right to privacy. Individuals may face the risk of their private thoughts and mental processes being exposed without their consent. Unauthorised access to neuro-data could be exploited for surveillance, manipulation, and violations of personal autonomy and agency. Safeguarding the right to privacy in the context of neurotechnologies is crucial to maintain individual autonomy, agency, and protect personal information. There are particular contexts in which the issues are even more pressing, such as with data of minors.

Meaningful Informed Consent: Neurotechnologies often involve the collection of sensitive data, such as brain activity or neural patterns. Hence, means for obtaining meaningful informed consent from impacted individuals are of outmost importance. This should include providing tools for achieving proper understanding of the implications and potential risks associated with these technologies, and a posteriori safeguards (e.g. right to be forgotten). There are also specific populations that require special considerations, such as minors, people with cognitive disabilities or communication impairments. Balancing the need to protect minors' and other specific populations rights and autonomy with their cognitive and emotional development is a complex task.

Ethical Use and Equity: Implementing neurotechnologies in diverse areas of applications should be guided by ethical considerations and principles. It is essential to address concerns regarding diversity, equity, and inclusion in the fair use of these technologies. Additionally, it is important to scrutinize and correct potential biases, assumptions, and limitations of neurotechnologies to avoid sustaining or exacerbating existing inequalities.

Psychological Well-being and Social Impact: Introducing neurotechnologies in both medical and non-medical areas of application can have important psychological and social implications for users. The potential monitoring of neural activity or the use of cognitive enhancement techniques may impact user’s self-perception, emotional well-being, and social dynamics. A critical challenge is to ensure that the implementation of neurotechnologies in a diversity of applications supports user’s well-being and promotes inclusive practices.

6. What groups are more vulnerable or at risk? Please, identify three and explain why.

Children and Adolescents: Children and adolescents are a particularly vulnerable group in the context of neurotechnologies. Their cognitive and neurological development is still ongoing, and they may not have the capacity to fully understand the implications and risks associated with these technologies. Additionally, there is a risk of misuse or exploitation, such as the unauthorised collection of neural data or the influence of cognitive enhancement techniques on their development. Protecting the rights and well-being of children and adolescents is needed to help ensure they are not subjected to harm, discrimination, or undue influence.

Neurodiverse Individuals: People with different ability levels, especially those with neuro-psychiatric disorders and neurological disease and trauma, may be more vulnerable to the risks associated with neurotechnologies. While these technologies have the potential to enhance their quality of life, there is also danger of exploitation, discrimination, or stigmatisation. For instance, these individuals could be subject to unwanted, unnecessary, or ineffective interventions. Furthermore, the use of neurotechnologies in employment or education settings may lead to potential discrimination or exclusion based on perceived abilities or neurological differences. Special consideration must be given to ensure that neurotechnology use promotes an individual's inclusion, opportunity, and empowerment regardless of their ability level.

Minority and Marginalised Communities: Minority and marginalised communities, including, but not limited to, racial and ethnic minorities, LGBTQ+ individuals, and socio-economically disadvantaged populations, are often disproportionately and negatively affected by various societal issues. The development and use of neurotechnologies have the potential to amplify existing inequalities experienced by these communities. For example, discriminatory practices based on neural characteristics or mental health status could further marginalise already vulnerable populations. Lack of access to advanced neurotechnological resources and services, for instance in the case where neurotechnologies prove themselves efficient for cognitive enhancement, may deepen demographic group gaps, preventing equal opportunities for these communities. Such disparities must be addressed to assure equitable access, protection, and fair treatment for all members of society.

7. What methods can be used to identify and assess the potential risks and impact of these technologies on human rights, in particular the human rights of persons with disabilities and other groups in vulnerable situations? Will such risks be amplified by the development of consumer-oriented neurotechnologies?

8. From a human rights perspective, what opportunities could the use of neurotechnologies bring? Can these opportunities be balanced against the identified risks and impact?

Potential Opportunities:

Healthcare Advancements: Neurotechnologies have the of improving diagnosis, treatment, and monitoring of neurological and mental health conditions. They can enable more accurate and objective assessments, precise personalized therapies, and targeted interventions. For example, brain-computer interfaces (BCIs) can help individuals with paralysis regain mobility, and neuroimaging techniques can aid in early detection of neurological disorders. These advancements can enhance the right to health by providing individuals with improved access to effective and tailored treatments.

Wellness Advancements: Neurotechnologies are also being explored in the wellness field in order to help individuals achieve wellness goals including relaxation, mindfulness, stress reduction, attention enhancement, and sleep regulation, among others. Wellness neurotechnologies may overlap with existing medical technologies, especially when they exist as repurposed medical technologies. They are generally available to individuals without a prescription because of no product treatment claims and are not necessarily monitored as part of clinician treatment practices. Most of these technologies are non-invasive and hence promise to offer some of the benefits of medical technologies.

Assistive Technologies and Neurodiversity: Neurotechnologies can empower individuals with disabilities by providing them with assistive devices and adaptive technologies. These technologies can enhance communication, mobility, and independence for people with neurological conditions, such as motor impairments or neurodevelopmental disorders. By promoting neurodiversity and inclusivity, these advancements can contribute to the realisation of the rights to equality, non-discrimination, and full participation in society.

Cognitive Enhancement and Education: Neurotechnologies offer opportunities for cognitive enhancement, which can enhance perceptual and cognitive abilities, such as learning, memory, attention, and problem solving. These technologies can potentially support educational systems and methodologies by providing personalised learning experiences and addressing learning difficulties. By ensuring equal access to cognitive enhancement tools, the right to education can be advanced, allowing individuals to improve their performance outcomes and participate more actively in society.

Balancing these opportunities against the identified risks and impacts is essential to ensure that the use of neurotechnologies respects human rights. Robust legal and ethical frameworks should be in place to safeguard privacy, protect against discrimination, and ensure informed consent. It is crucial to address concerns regarding data protection, potential misuse, and unintended consequences of these technologies, especially consumer neurotechnologies, including wellness neurotechnologies, with often lower government and industry regulatory standards for device design, performance, and use intent. Responsible research, regulation, and transparent governance are necessary to mitigate risks and maximize the benefits of neurotechnologies in a manner that upholds human rights values and principles. Decisions involving regulatory policies, practices, and enforcement should be rendered through diverse stakeholder engagement and caucusing, such as that achieved through community-based organizations, professional societies, civil and municipal bodies, and legal authorities , so that human rights considerations and technology benefits and risks are rigorously assessed through a lens of diversity, equity, and inclusion.

*National framework*

9. Is the national legal framework adequate to face the challenges that the development, test and use of neurotechnologies pose to human rights? Please explain briefly and indicate the relevant pieces of legislation and whether there are plans to develop any (or further) legislation.

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10. Does national legislation on privacy and data protection cover mental privacy[3] and/or personal brain data?[4] Please explain.

This group includes people from different countries. Here we identify some national legal instruments that we are aware of.

National legislation on privacy and data protection cover mental privacy and personal brain data, as these documents do not refer uniquely to one type of data vs. another (e.g. HIPPA does not only discusses personal data connected to genetics, it cover all personal health data, which would include brain data).

[GDPR](https://gdpr-info.eu/) UK/EU context:

Article 4 ‘personal data’ means any information relating to an identified or identifiable natural person (‘data subject’) which includes ‘mental’ as an identifier

Article 9 Processing of special categories of personal data, including biometric data, to for the purpose of uniquely identifying a natural person

Article 50 International cooperation for the protection of personal data. The storage and transfer of ‘mental data’ across international boundaries need to ensure maximum protection for the individuals (identifiable person) data.

*Recital 35* Health Data\*

*Recital 51* Protecting Sensitive Personal Data\*

*Recital 91* Necessity of a Data Protection Impact Assessment\*

11. From a human rights-protection perspective, what are the main domestic regulatory gaps that can be identified? What legal (or other) measures are necessary to avoid human rights violations arising from the use of neurotechnologies in your opinion?

12. Is your national institutional framework for human rights well-equipped to address the new challenges posed by neurotechnologies?

13. What national entity would be best placed to exercise scrutiny and oversight to prevent potential abuses or misuses derived from the use of neurotechnologies? Is there any procedure in place to that effect?

*International framework*

14. What are the main international regulatory and governance gaps that you have identified as regards neurotechnology and human rights?

 There are guidelines and recommendations, some of them like the OECD neurotechnology guidelines only applied to OECD member states. Others are country specific (eg. NIH neurotech guidelines, UK Horizon Council), and others are very much academic in nature (Goering et al, 2022, Neuroethics). While there has been an intense discussion around human rights and neurotechnology (See UNESCO report(s): The risks and challenges of neurotechnologies for human rights (2023) and UNESCO’s International Bioethics Committee (IBC) on ethical issues of neurotechnology (2021)), there has been gaps in terms of international governance mechanisms. Despite significant content overlap, these initiatives seemed fragmented and there is little guidance on how can they be implemented in practice by researchers and innovators. Likewise, there is no yet clarity on how these soft law mechanisms, can be complemented by binding regulatory and legal frameworks that allow proper enforcement.

Another relevant regulatory and governance gap is the need to include culturally specific recommendations while still allowing for international scope. These gaps have started to be address by UNESCO work in the area (See UNESCO report(s): The risks and challenges of neurotechnologies for human rights (2023) and UNESCO’s International Bioethics Committee (IBC) on ethical issues of neurotechnology (2021)), but clearly much more work remains.

15. What actions would you advocate for to address these gaps and potential human rights impact at the international level? Please elaborate on specific normative or institutional measures you would propose and assess the feasibility of their implementation.

IEEE Brain, with its international focus, can help with some of the gaps in terms of identifying issues that might not be the common ethical, legal, social and additional issues discussed in specific regions (e.g. North America, Europe or Asia-Pacific).

As part of the Neuroethics Framework, we have based most of our assessment using a responsible research and innovation approach, and have tackled ethical, legal, social and cultural implications (ELSCI) issues emerging from the use of neurotechnology for a variety of applications (medical, wellness, education, workplace, military and others). The framework has helped as a basis to create the first socio-technical standard focused on neurotechnology (IEEE SA P7700). This work is still in progress, but the idea is to continue developing other standards under this broader recommended practice. IEEE has successfully worked and implemented socio-technical standards in the AI sphere, with a certified platform that is being tested.

Addressing these challenges requires a multi-faceted approach that involves ethical guidelines, legal frameworks, educational policies and practices, and collaboration between educators, researchers, mental healthcare professionals, policymakers, and other relevant stakeholders including young people and their families. Prioritising the rights and well-being of students while harnessing the potential benefits of neurotechnologies in education is crucial to ensure responsible and equitable use of these technologies.

16. What international organization, bodies, or agencies would be in your opinion best placed to oversee and prevent potential abuses or misuses resulting from the use of neurotechnologies?

In addition to traditional bodies or agencies (like UN Human Rights Council, UNESCO or OECD) that could help to oversee potential abuses and misuses, professional organizations like IEEE, could also take an important leading role in preventing abuses or misuses resulting from the use of neurotechnologies.

II. Private actors and other stakeholders with experience or expertise in the subject-matter, such as medical and technical communities, and academic institutions (specific questions)--AS

17. What specific characteristics would you emphasise as unique and distinctive of neurotechnologies?

From the perspective of people involved in IEEE efforts in non-medical areas of application, as one of the largest technical communities, we see neurotechnologies to be significantly different from any other technologies, as they enable the possibility to record and stimulate activity of the brain and nervous system. Compared to other organs, the brain is considered the seat of all our bodily functions, agency and behavior. Some of the unique and distinctive characteristics are:

1. Access to mental content, states, and processes: More and more neurotechnologies have the capability to making predictive and attributional inferences about cognition and emotion as well as generating simulated or artificial cognitive and emotional manifestations. These possibilities raise significant concerns regarding mental privacy, agency, and autonomy. Safeguarding mental privacy becomes crucial, as the implications of accessing and utilizing this information can be far-reaching for individuals and society.
2. Lack of Consent and Autonomy: Unlike other technologies that require explicit consent from users, neurotechnologies can potentially operate without the need for user consent or full autonomy, especially in the context of direct-to-consumer technology. This aspect raises important ethical questions regarding the individual's right to make autonomous decisions about the use of such technologies and the potential for coercion or manipulation.
3. Augmentation of Identity and Agency: Neurotechnologies may have the ability to augment neural activity, leading to implications for personal identity and agency. The alteration or manipulation of thoughts, behaviors, or emotions through these technologies challenges notions of authenticity and free will, potentially impacting human rights related to self-determination and individual autonomy.

18. Have you introduced or are you considering introducing any adjustment to your activities or business model such as incentives, indicators or performance metrics of governance in response to these specific characteristics? Please explain.

IEEE has been working on incentives, indicators and performance metrics of governance through different initiatives focused on neurotechnology or with a large overlap with neurotechnologies, including activities from the IEEE Ethically-aligned design, the IEEE Brain Neuroethics framework and the P7700 WG.

IEEE Neuroethics framework: a detailed framework detailing ethical, legal, social and cultural implications of different neurotechnologies across different application domain, making it easier for developers, companies and other relevant stakeholders to navigate the landscape of issues.

IEEE SA P7700 WG: we have started working on the first IEEE socio-technical standard with a focus on neurotechnology, which end goal is to deliver a fully flesh standard together with a set of performance metrics once completed.

19. Has your company/organization undertaken any specific action or measure to mitigate impacts arising from the use of neurotechnologies? Are any of these actions or measures specifically addressed to mitigate human rights risks?

20. Does your company or organization implement the principles for responsible innovation in neurotechnology?[5] Please elaborate.

IEEE Brain with a team of international stakeholders, including among others, academicians, researchers,, activists, engineers, policymakers, and corporate leaders, are developing a Neuroethics Framework that discusses the Ethical, Legal, Social, and Cultural Implications (ELSCI) of Neurotechnology. This framework, as a soft governance tool, will be able to provide basic guidelines and recommendations for evaluating any neurotechnology for ELSCI, but also for identifying and understanding the unique challenges that come with different neurotechnology applications and their validation.

Currently, the Neuroethics Framework is divided into sub-groups that focus on use of neurotechnology for medical, wellness, education, workplace, military, sports, entertainment and legal purposes.

21. Has your company or organization developed or plans developing (or adopting) an ethical code of conduct or human rights strategy for the development, testing or commercialization of neurotechnologies? Please outline such initiatives and provide a copy of relevant documents, if possible.

22. What national regulation or framework do you consider is needed to avoid a potentially negative human rights impact of neurotechnology?

23. Which regulatory framework such as application of specific, sectorial, national, autoregulation or a combination of them do you believe is best suited to the specific characteristics of neurotechnologies?

There is a need for a framework that potentially combines various elements of neurotechnology into one comprehensive international regulatory framework. Country-specific frameworks and guidelines such as the European Union's Medical Devices Regulation (MDR) or the U.S. Food and Drug Administration's (FDA) regulations for medical devices are well focused on the medical aspect of neurotechnologies, while general guidelines such as the Declaration of Helsinki are well followed by research ethics committees around the world.

With respect to misuse of data privacy and protection in neurotechnologies, some of the national guidelines are tuned for neurotechnologies such as the European Union’s General Data Protection Regulation (GDPR) and similar laws in other countries..

In addition to government funded regulatory framework, professional bodies like IEEE Standard can develop and enforce ethical guidelines specific to the use of neurotechnologies with IEEE Brain Neuroethics Framework being one of these ongoing initiatives.

III. International and regional organizations; United Nations agencies, funds and programmes; national human rights institutions; and civil society (specific questions)

24. Please outline the relevant work that your organization, agency or department has done in relation to neurotechnology and human rights. Please share the main outcomes and recommendations (if applicable).

The IEEE Neuroethics Framework is one of the initiatives setup by the IEEE, which is composed of several workgroups focusing on neurotechnologies for different intended uses including wellness, legal, sports, military, among others. The focus has been on neurotechnologies that are used to monitor, stimulate, and otherwise modify the human nervous system. Over the last two years several groups of volunteers have put together a series of white papers intended to provide developers of neurotechnologies with guidance about the ethical issues that might arise, touching upon legal implications and human rights, specifically data privacy rights. Each white paper is thematically oriented, and we have been spearheading work on documents (one for each intended purpose) that addresses neurotechnologies, and the associated ethical, legal, cultural, and societal implications.

Main outcomes

The work we have been doing as part of IEEE BRAIN Neuroethics Framework, has led to the next phase which is the development of a series of socio-technical standards discussing neurotechnology. The first one of this has been approved by IEEE Standard Association, and there is an active work group working on this very first standard (P7700) “Recommended Practice for the Responsible Design and Development of Neurotechnologies”. So while we do not have as of now guidelines and recommendations to offer we hope in the coming years this first standard will be published, and others within the scope of neurotechnology will have been started.

25. Please describe any measures undertaken aimed at coordinating, collaborating or seeking synergies with the work of other organizations in relation to neurotechnology.

While we have mature documents, we recognize that it might have a cultural bias towards North American and European perspectives. Therefore, we have been working on organizing regional meetings (i.e. Asian, European, and Latin American) to make our documents inclusive and culturally-appropriate in respect to the development of neurotechnologies. These meetings will include a number of stakeholders, such as neurotech representatives, ethicists, scientists, and patient organizations.

We believe that by doing so, the documents and meetings will provide opportunities to identify areas of collaboration and synergies to advance the understanding of developing responsible neurotechnologies among different stakeholders, while taking human rights into consideration. In addition, the meetings will facilitate networking and highlighting culturally-relevant priorities that may facilitate partnerships in the future to tackle policy initiatives. Through dialogue and collaboration, the regional meetings can contribute to harmonizing ethical standards and guidelines across different regions. Identified commonalities and differences in ethical frameworks, legal implications, and human rights perspectives may facilitate working towards establishing a global consensus on the ethical use of neurotechnologies.

26. What are the main international regulatory and governance gaps that you have identified as regards neurotechnology and human rights?

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[1] OECD, “Recommendation of the Council on OECD Legal Instruments Responsible Innovation in Neurotechnology”, 2019; “Neurotechnology and Society: Strengthening Responsible Innovation in Brain Science”, OECD Policy Papers, November 2017, p. 49.

[2] UNESCO, “Report of the International Bioethics Committee of UNESCO (IBC) on the Ethical Issues of Neurotechnology”, 2021, p.5.

[3] “Mental privacy” refers to the explicit protection of individuals against the unconsented intrusion by third parties into their mental information (be it infrerred from their neural data or from proxi data indicative of neurological, cognitive and/or affective information) as well as against the unauthorized collection of those data. Ienca, M. and Andorno, R. “Towards new human rights in the age of neuroscience and neurotechnology”, *Life Sciences, Society and Policy*, Vol. 13, n. 5, 2017.

[4] “Personal brain data” or “neural data” is defined as the data relating to the functioning or structure of the human brain of an identified or identifiable individual that includes unique information about their psicology, health or mental states (OECD, 2019).

[5] See, for example: OECD, “Recommendation of the Council on OECD Legal Instruments Responsible Innovation in Neurotechnology”, 2019.