
Promoting innovation, protecting human rights, and ensuring the ethical development of neurotechnology.

# International Human Rights Protection Gaps in the Age of Neurotechnology

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## EXECUTIVE SUMMARY

*International Human Rights Protection Gaps in the Age of Neurotechnology* is the first comprehensive review of international human rights law as applied to neurotechnology. Neurotechnology, defined as methods to directly record or modify human brain activity, is an emerging source of medical and scientific advancement, economic development, and consumer demand. The brain is the source of human mental and cognitive processes, imagination, perception, and memory. Because it directly interacts with the brain, neurotechnology is expected to profoundly alter what it means to be human. There is enormous potential for states, companies, and non-state actors to infringe upon human rights through the misuse or abuse of neurotechnology. Without the continued development of international human rights law, there are today a wide array of human rights protection gaps. Moving forward, developing a common approach to neurotechnology across the United Nations ("UN"), further interpretation of current international human rights treaties, new soft law instruments, and a code of conduct for states and neurotechnology companies would put the international community in the best position to confront and to fill these gaps.

Today, existing frameworks for regulating neurotechnology are exclusively soft law and highly decentralized, including the Organization for Economic Co-operation and Development ("OECD") Recommendations on Responsible Innovation in Neurotechnology,[1] the Declaration of the Inter-American Juridical Committee on Neuroscience, Neurotechnologies, and Human Rights,[2] the Tshwane Principles on National Security and the Right to Information,[3] the National Institutes of Health ("NIH") Neuroethics Guiding Principles for the U.S. BRAIN Initiative (2018),[4] and the IEEE Neuroethics Framework,[5] among others. Yet, these frameworks address neither the human rights challenges of neurotechnology, nor how they may or may not be justiciable under existing international human rights law. Similarly, the report of the International Bioethics Committee of the UN Educational, Scientific and Cultural Organization ("UNESCO") on ethical issues and neurotechnology[6] is neither grounded in binding law, nor does it apply international human rights law to inform its policy recommendations. Therefore, developing a unified approach at the UN is critical, especially as the number of competing and differing soft law ethical standards are growing.

The UN's cross-cutting approach to neurotechnology should begin with a common framework for analysis – existing international human rights treaties. Using these treaties to examine the potential misuse and abuse of neurotechnology efficiently uses the existing machinery

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[1] Org. for Econ. Co-operation & Dev. [OECD], *Recommendation of the Council on Responsible Innovation in Neurotechnology*, Doc. No. OECD/LEGAL/0457, *adopted* Dec. 11, 2019 [hereinafter OECD/LEGAL/0457].
[2] DECLARATION OF THE INTER-AMERICAN JURIDICAL COMMITTEE ON NEUROSCIENCE, NEUROTECHNOLOGIES, AND HUMAN RIGHTS: NEW LEGAL CHALLENGES FOR THE AMERICAS, INTER-AMERICAN JURIDICAL COMMITTEE, CJI/DEC.01 (XCIX-O/21), Aug. 11, 2021, *available at* http://www.oas.org/en/sla/iajc/docs/CJI-DEC_01_XCIX-O-21_ENG.pdf [hereinafter DECLARATION OF THE INTER-AMERICAN JURIDICAL COMMITTEE].
[3] TSHWANE PRINCIPLES ON NATIONAL SECURITY AND THE RIGHT TO INFORMATION, OPEN SOCIETY FOUNDATIONS JUSTICE INITIATIVE, *finalized* June 12, 2013, *available at* https://www.justiceinitiative.org/uploads/45d4db46-e2c4-4419-932b-6b9aadad7c38/tshwane-principles-15-points-09182013.pdf [hereinafter TSHWANE PRINCIPLES].
[4] Henry T. Greely, Christine Grady, & Khara M. Ramos, et al., *Neuroethics Guiding Principles for the NIH BRAIN Initiative*, 38 J. OF NEUROSCIENCE 10586, Table 1 (2018) [hereinafter *Guiding Principles for NIH Brain Initiative*].
[5] IEEE NEUROETHICS FRAMEWORK, IEEE, 2021, *available at* https://brain.ieee.org/publications/neuroethics-framework/addressing-the-ethical-legal-social-cultural-implications-of-neurotechnology/.
[6] REPORT OF THE INTERNATIONAL BIOETHICS COMMITTEE OF UNESCO (IBC) ON ETHICAL ISSUES OF NEUROTECHNOLOGY, UNESCO, 2021, *available at* https://unesdoc.unesco.org/ark:/48223/pf0000378724.

of the UN human rights system to collect, clarify, and explain States' legally binding obligations. With further interpretation, it will drive the creation of new national laws and regulations on neurotechnology.

Given the massive scale of global neurotechnology investment, now is the time to anticipate and to proactively fill human rights protection gaps created by neurotechnology. The 2013 U.S. BRAIN Initiative, launched by the Obama Administration, is a multi-billion dollar[7] initiative involving the work of three government agencies – the NIH, the National Science Foundation, and the Defense Advanced Research Projects Agency ("DARPA").[8] Since 2013, five other BRAIN initiatives have been created around the world, including the European Human Brain Project,[9] and China's BRAIN Project, announced in 2016, which has allocated funding of $1 billion through the year 2030.[10] Sources report an increase of 62% in global neurotechnology investment between 2019 and 2020,[11] and the global neurotechnology market is presently valued at $10.7 billion (2020) and is expected to reach $21 billion by 2026.[12] The BRAIN Initiative sparked a wave in global neurotechnology investment. Between 2010 and 2014, the number of neurotechnology patents more than doubled from 800 to 1,600 annually, most of which have been awarded to private inventors outside of medical device companies.[13]

The UN is poised to play a key leadership role on neurotechnology and human rights. The Neurorights Foundation has engaged senior officials at the UN on the global state of neurotechnology's development and use; opportunities and risks it poses for the advancement of human rights; and applicable legal, ethical, and governance frameworks. The Neurorights Foundation then authored *International Human Rights Protection Gaps in the Age of Neurotechnology* to analyze the ways in which existing international treaties fail to address novel human rights challenges in the neurotechnological age, or "**neurorights**." Neurorights, explained in greater detail in this report include (1) the right to mental identity, or a "sense of self," (2) the right to mental agency, or "free will," (3) the right to mental privacy, (4) the right to fair access to mental

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[7] While it is difficult to find an exact figure for the total money spent on the BRAIN Initiative since 2013, the following sources indicate that its expenditures already total billions of dollars and will likely increase. *See, e.g.*, *How Will the BRAIN Initiative be Supported by NIH?*, NAT'L INST. OF HEALTH, *accessed* May 3, 2022, *available at* https://braininitiative.nih.gov/about/overview (noting that the NIH has spent approximately $2.4 billion on BRAIN Initiative awards) and *Congress Passes Budget Bill: NIH BRAIN Initiative Receives $60 Million in Additional Funds for Fiscal Year 2022*, NAT'L INST. OF HEALTH, Mar. 29, 2022, *available at* https://brainblog.nih.gov/brain-blog/congress-passes-budget-bill-nih-brain-initiative-receives-60m-additional-funds-fiscal-0 ("the recently authorized Omnibus Appropriations Bill for fiscal year 2022 . . . authorizes $620 million for the NIH BRAIN Initiative").

[8] *BRAIN Initiative Participants*, BRAIN INITIATIVE, *accessed* May 3, 2022, *available at* https://www.braininitiative.org/participants/.

[9] *Short Overview of the Human Brain Project*, EUROPEAN UNION (last updated 2022), *available at* https://www.humanbrainproject.eu/en/about/overview.

[10] *Neurotechnology for National Defense*: *The U.S. and China*, THE CIPHER BRIEF, July 1, 2021, *available at* https://www.thecipherbrief.com/column_article/neurotechnology-for-national-defense-the-u-s-and-china.

[11] *Global Neurotech Industry Investment Digest (2021)*, DEEP KNOWLEDGE GROUP FOR EIN NEWS, July 14, 2021, *available at* https://www.einnews.com/pr_news/546252348/global-neurotech-industry-investment-digest-2021.

[12] *Global Neurotechnology Market Outlook*, EXPERT MARKET RESEARCH, May 25, 2021, *available at* https://expertmarketresearch-emr.blogspot.com/2021/05/global-human-augmentation-market-is.html.

[13] Unnati Mehta, Brian Barnett & Jennifer Buss, TRENDS IN NEUROTECHNOLOGY, POTOMAC INSTITUTE FOR POLICY STUDIES, Aug. 2015, at 5, *available at* https://www.potomacinstitute.org/images/stories/publications/NeuroTrendsAug2015.pdf.

augmentation, and (5) protection from algorithmic bias, such as when neurotechnology is combined with artificial intelligence ("AI.")[14]

Thus, *International Human Rights Protection Gaps in the Age of Neurotechnology* both builds upon and applies these past discussions with senior UN officials by fulfilling two critical objectives. First, it analyzes protection gaps under international human rights treaties that should be filled to address the conceivable misuse and abuse of current and future neurotechnology. And second, it provides a path forward for a cross-UN approach to lead global efforts to protect neurorights.

This report analyzes neurorights protection gaps arising under the following core UN international human rights treaties:[15] the International Covenant on Civil and Political Rights ("ICCPR"), Convention Against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment ("CAT"), International Covenant on Economic, Social and Cultural Rights ("ICESCR"), Convention on the Rights of Persons with Disabilities ("CRPD"), Convention on the Elimination of All Forms of Racial Discrimination ("CERD"), Convention on the Elimination of All Forms of Discrimination Against Women ("CEDAW"), and Convention on the Rights of the Child ("CRC").[16]

This report also acknowledges protection gaps arising under several declaratory, or nonbinding, international human rights standards, including the Universal Declaration of Human Rights ("UDHR"), the Principles of Medical Ethics relevant to the Role of Health Personnel, particularly Physicians, in the Protection of Prisoners and Detainees against Torture and Cruel, Inhuman or Degrading Treatment or Punishment ("Principles of Medical Ethics"), and the Universal Declaration on Bioethics and Human Rights ("Bioethics Declaration").

**Our report ultimately concludes that the existing body of international human rights treaties, general comments, and jurisprudence is ill-equipped to protect neurorights.** Particularly, this report identifies two main trends in existing treaties. First, the more detailed a treaty's provisions currently are, the less applicable they will be to neurotechnology. Broader provisions, especially in older treaties, such as CERD, will be more easily further interpreted through general comments[17] to address neurorights.

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[14] Rafael Yuste & Sara Goering, et al., *Four Ethical Priorities for Neurotechnologies and AI*, 551 NATURE 159, at 161-62 (2017), *available at* https://www.nature.com/articles/551159a [hereinafter *Four Ethical Priorities*]; Marcella Ienca & Roberto Andorno, *Towards New Human Rights in the Age of Neuroscience and Neurotechnology*, 13 LIFE SCI., SOC'Y & POLICY 5 (2017), *available at* https://lsspjournal.biomedcentral.com/articles/10.1186/s40504-017-0050-1 [hereinafter Ienca & Andorno].

[15] *The Core International Human Rights Instruments and Their Monitoring Bodies*, U.N. OFFICE OF THE HIGH COMMISSIONER FOR HUMAN RIGHTS, *available at* https://www.ohchr.org/en/professionalinterest/pages/coreinstruments.aspx.

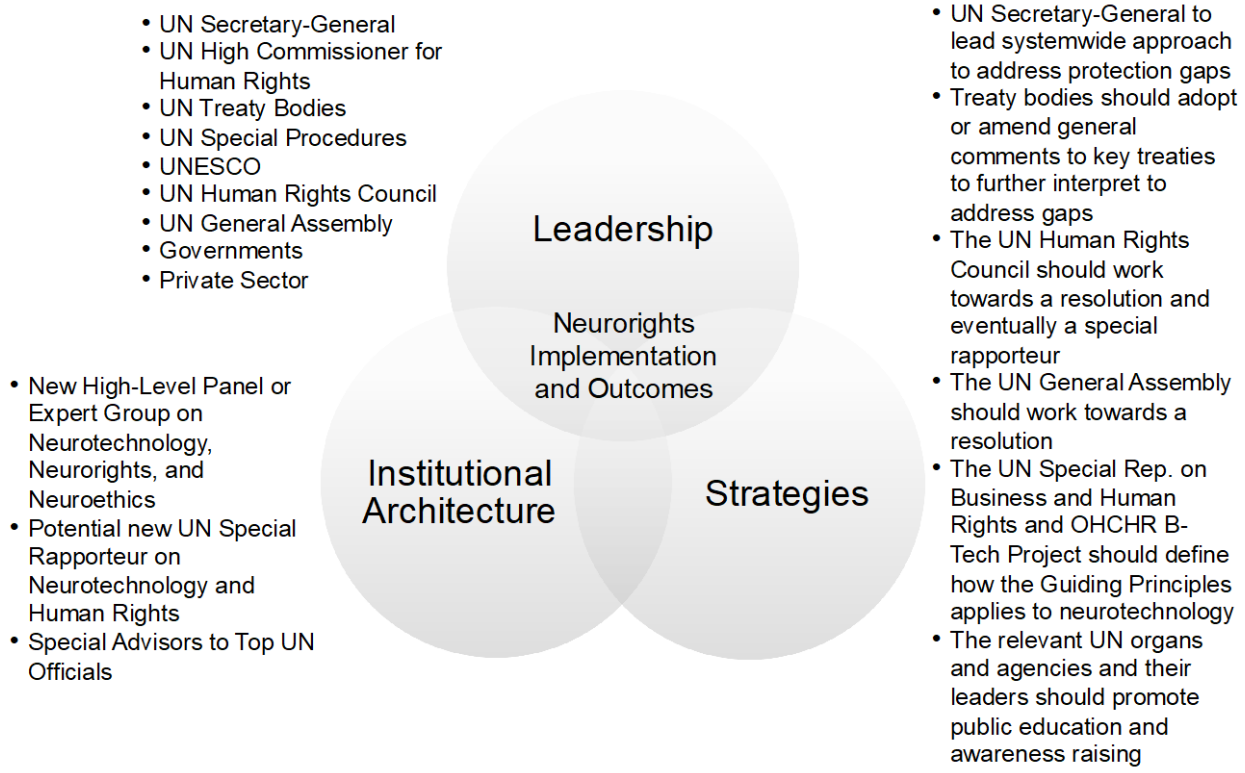
[16] These human rights instruments were selected for their relevance to neurotechnology and human rights. Although the UN also considers both the Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families and the Convention for the Protection of All Persons from Enforced Disappearance to be core international human rights instruments, it is our view that their provisions do not as clearly highlight the protection gaps created by neurotechnology.

[17] Each major treaty's interpretation, its evaluation of state conduct, and, in cases where authorized, in adjudicating individual complaints lodged against states are overseen by a "treaty body." These are groups of experts that are elected by the states that have ratified the treaty to fulfill these important responsibilities. Treaty bodies may, at their discretion, consider, adopt, or even later amend so-called "general comments," which are detailed interpretations of specific treaty provisions, which are binding on all state parties.

Second, both general comments to treaties and UN reports from more recent years tend to mention technological advances which could be further interpreted to include neurorights. And some of the standards applied to AI and other technologies may also apply to neurotechnology. Ultimately, however, none of the international human rights treaties fully anticipate the fundamental ways in which neurotechnology may change the human experience (such as through mind reading and augmented realities) and all should be updated – whether through general comments or the provisions themselves – to reflect this new reality. Emerging technologies are no longer solely concerns for accessibility, privacy, and discrimination-related reasons. Today, neurotechnology also presents concerns for mental integrity, free will, the development of thought, the protection of due process, and inequality of human enhancement.

Based upon these findings, *International Human Rights Protection Gaps in the Age of Neurotechnology* makes policy recommendations and provides a basis for both the UN and national governments to determine their next steps in protecting individuals from the misuse and abuse of neurotechnology. These recommendations include:

## PROPOSED PATH FORWARD FOR THE UNITED NATIONS TO ADVANCE NEURORIGHTS IN THE AGE OF NEUROTECHNOLOGY



## MAJOR FINDINGS

*International Human Rights Protection Gaps in the Age of Neurotechnology* first identifies protection gaps under international human rights treaties that should be filled to address the conceivable misuse and abuse of current and future neurotechnology. Second, it recommends a path forward for the UN to lead global efforts to protect neurorights. The major findings of this report include:

*Protection Gaps*

- **Existing UN international human rights treaties are currently ill-equipped to protect neurorights.** Nevertheless, some of their accompanying general comments and recommendations are written broadly enough to encompass some transformative technologies. For example, the Committee on the Rights of Persons with Disabilities' General Comment No. 6 on Article 5 of CRPD mandates the equal access of assistive technologies for persons with disabilities.[18] "Assistive technologies" is broad enough to contemplate any new technology. By contrast, the Human Rights Committee's General Comment No. 22 on Article 18 of the ICCPR, the freedom of thought, conscience, and religion, fails to define "conscience."[19] This failure creates a protection gap for misuse and abuse of neurotechnology devices which can interfere with an individual's sense of self and free will (identity and agency).

- **The "neurorights" framework is a growing source of consensus for characterizing the potential misuse and abuse of neurotechnology.** Global governance frameworks for regulating neurotechnology, including the OECD Recommendations, the Declaration of the Inter-American Juridical Committee on Neuroscience, Neurotechnologies, and Human Rights, the Tshwane Principles, the NIH Guiding Principles, the Republic of Chile's constitutional amendment, and Spain's Digital Rights Charter, all reflect variations of the five expert-backed neurorights: (1) agency, (2) identity, (3) mental privacy, (4) equal access to mental augmentation, and (5) protection from algorithmic bias.

- **The "best protected" neuroright is the right to agency, followed by freedom from algorithmic bias.** The neuroright to agency is at least somewhat protected under the language of the ICCPR, CAT, ICESCR, and CRC. That is, the language of multiple provisions is broadly crafted to protect infringements of protected rights through the misuse or abuse of neurotechnology. The concept of free will, even if it is not defined with neurotechnology's specific risks in mind, is thoroughly present in international human rights law. The neuroright to be free from algorithmic bias is at least somewhat protected under the language of the treaties and their accompanying general comments, including the ICCPR, ICESCR, CRPD, CERD, and CRC.

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[18] *General Comment No. 6 on Article 5*, U.N. COMM. ON RIGHTS OF PERSONS WITH DISABILITIES, U.N. Doc. CRPD/C/GC/6, Apr. 26, 2018, at ¶¶ 24-28, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/G18/119/05/PDF/G1811905.pdf?OpenElement.

[19] *See generally General Comment No. 22 on Article 18*, U.N. HUMAN RIGHTS COMM., U.N. Doc. CCPR/C/GC/22, July 30, 1993, *available at* https://www.refworld.org/docid/453883fb22.html.

- **The "worst protected" neuroright is identity.** The ICCPR, CRPD, CERD, and CRC reckon with identity formation and retention. However, relevant terms which help explain the concept of identity are ill-defined. ICCPR Article 18, for instance, does not define "conscience." The CRC does not define what it means for a child to form an identity. And there are no indicators discussed in any of the treaties, general comments, or jurisprudence of the types of information which strongly disrupt the sense of self.

*The Path Forward for the United Nations*

- **The UN Secretary-General should lead a systemwide approach to address neurorights protection gaps. It may be helpful, for example, to create a High-Level Panel on Neurotechnology, Neurorights, and Neuroethics.** A High-Level Panel or Expert Group should include stakeholders from the international and national levels, as well as from industry. Ultimately, however, addressing the distinct human rights challenges highlighted by neurotechnology will require coordination and collaboration among the UN Secretary-General, the UN High Commissioner for Human Rights, UNESCO, the UN Human Rights Council, the UN Treaty Bodies, and the UN Special Procedures, among others.

- **The treaty bodies to each major international human rights treaty should, through the adoption or amending of general comments, further interpret relevant provisions of those treaties to account for the potential misuse and abuse of neurotechnology.** According to the Office of the High Commissioner for Human Rights ("OHCHR"): "[T]here may be some interpretation and implementation gaps, the extent of which need further exploration."[20] General Comments to existing human rights treaties should distinguish between invasive and non-invasive brain-computer interfaces ("BCIs") to fully close protection gaps. For example, under the CAT's definition of torture, there must be "severe mental suffering." If state officials were to force individuals to receive an invasive BCI to coerce confessions, they have perpetrated torture. But where a non-invasive BCI is used to extract a confession and imposes no injury, mental suffering, trauma, or nerve damage, it may not satisfy the definitional threshold for torture or even meet the current interpretation of cruel, inhuman, or degrading treatment or punishment. If left unchanged, this protection gap could incentivize law enforcement in the future to use non-invasive BCIs to coerce confessions.

- **The UN may wish to consider the creation of new soft law, which would be non-binding standards on neurotechnology and human rights, such as by the adoption of a UN General Assembly resolution or declaration, to codify an international consensus on neurorights.** Further interpretation of treaties and adoption of a new soft law will drive the development of national and legal regulatory frameworks. Based on an evaluation of the effectiveness of these measures over time, it can be determined in the future if there are sufficient unfilled protection gaps that might require consideration of the development and

[20] *See Background Paper Relating to International Human Rights Law and Neurotechnology*, OHCHR, Mar. 2022 ("while there are proposals on the table to introduce new human rights . . . to address surfacing threats, the question that needs to be addressed first is if existing human rights law provides already a sufficient basis for tackling the emerging issues related to neurotechnology.").

adoption of a new, binding international human rights treaty which would explicitly enshrine neurorights in international law.[21]

- **In addition, relevant thematic UN Special Procedures[22] may also contribute to the development of further soft law standards by their reporting and engagement with states.** While only three Special Rapporteurs have directly addressed neurological interventions and neurotechnology, several other reports contain broad language about the human rights impact of new technologies which apply to neurorights. These reports have given an initial indication as to how their work in this field may expand over time. Moreover, while it would take time to get to this outcome, the UN Human Rights Council could adopt a resolution on neurorights and consider creating a UN Special Rapporteur on Neurotechnology and Human Rights.

- **The UN Special Representative on the Issue of Human Rights and Transnational Corporations and Other Business Enterprises and the OHCHR B-Tech Project, should work to further define how the Guiding Principles on Business and Human Rights apply to neurotechnology.** In addition to focusing the Guiding Principles, the Special Representative could create a "code of conduct" or report of best practices for protecting neurorights, aimed at neurotechnology companies. Such a report could resemble the International Labor Organization's industry-specific "code of practice" for employers,[23] or could resemble an industry-wide pledge, toolkit, and conduct framework, such as the UN Economic Commission for Europe's initiative to guide the garment and footwear industries on traceable supply chains.[24] The Special Representative may also want to address consumer neurotechnology, which is at best weakly regulated, leaving consumers vulnerable to violations of neurorights. The Neurorights Foundation, for example, is working to review user agreements of neurotechnology products to provide critical policy recommendations for neurotechnology companies and for the U.S. state and federal governments to help protect consumers. **Further, the OHCHR B-Tech Project should be expanded to explicitly include neurotechnology.** The B-Tech Project, which seeks to provide authoritative guidance and resources for implementing the Guiding Principles on Business and Human Rights in the technology space, has published a series of generalized papers and guidance on how the Guiding Principles apply to companies and investors, but does not mention

[21] *See id.* (Acknowledging the challenges of updating existing international human rights law while not ruling out the possibility that additional measures may be necessary to protect against the misuse and abuse of neurotechnology: "Evolving case law, new soft law instruments, and new domestic laws providing for specific safeguards could go far towards strengthening protections against abuses of neurotechnology, although much work will need to be done to ensure that result").

[22] The Special Procedures of the UN Human Rights Council are independent human rights experts with mandates to report and advise on human rights from a thematic or country-specific perspective. They are non-paid and elected for 3-year mandates that can be reconducted for another three years. As of October 2021, there are 45 thematic and 13 country mandates. *Special Procedures of the UN Human Rights Council*, UN HUMAN RIGHTS COUNCIL, *available at* https://www.ohchr.org/en/special-procedures-human-rights-council.

[23] *See ILO Adopts Code of Practice on Safety and Health in Textiles, Clothing, Leather and Footwear Industries*, INT'L LABOR ORGANIZATION, Oct. 8, 2021, *available at* https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_822368/lang--en/index.htm [hereinafter ILO].

[24] *Traceability for Sustainable Garment and Footwear*, UN ECONOMIC COMM'N FOR EUROPE, *available at* https://unece.org/trade/traceability-sustainable-garment-and-footwear.

neurotechnology.[25] The Project's Focus Area Four, which recommends a "smart mix" of policy and regulatory responses to protect human rights relating to digital technologies,[26] should also mention neurotechnology.

- **The UN Secretary-General, UN Human Rights Council, OHCHR, and UNESCO should promote public education and awareness raising of both the benefits and potential misuse and abuse of neurotechnology.** The Neurorights Foundation is already highly engaged in this work. In 2021, the Neurorights Foundation collaborated with German filmmaker Werner Herzog who created *Theater of Thought*, an artful documentary about neurotechnology's impact on the brain, which is expected to be launched in 2022. In this work, the UN should also engage relevant civil society actors and facilitate inclusive discussions about ethical neurotechnology with relevant stakeholders.

## INTRODUCTION

In September 2021, Secretary-General Guterres released his report, *Our Common Agenda*, and called upon the international community to better implement the Sustainable Development Goals by "clarifying our application of human rights frameworks and standards to address frontier issues and prevent harms in the digital or technology spaces, including … neuro-technology."[27] *Our Common Agenda* is the first report of the Secretary-General to mention neurotechnology.

Neurotechnology underscores the need for innovative approaches in human rights protection. Unlike other technologies, such as AI or digital technologies,[28] neurotechnology directly interacts with the human brain. Whereas AI algorithms can interpret and generate data based upon learned cues, neurotechnology can directly map and alter human brain activity. Neurotechnology also can store far more sensitive and detailed information about an individual's thoughts and identity than an algorithm alone could interpret. Within the next several years, it is further expected that neurotechnology will be able to write to the human brain.

### *A. The Global State of Neurotechnology*

At the heart of neurotechnology are brain-computer or brain-machine interfaces ("BCIs" or "BMIs"), or devices which connect a person's brain directly to a computer, a machine, or to another

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[25] *See, e.g.*, *B-Tech Project: OHCHR and Business and Human Rights*, OHCHR B-TECH PROJECT, *accessed* May 3, 2022, *available at* https://www.ohchr.org/en/business-and-human-rights/b-tech-project; *Overview and Scope*, OHCHR B-TECH PROJECT, Nov. 2019, *available at* https://www.ohchr.org/sites/default/files/Documents/Issues/Business/B-Tech/B_Tech_Project_revised_scoping_final.pdf; *Scoping Paper Takeaways Submission: Key Takeaways from Written Submissions Received from the Open Consultation on the Draft B-Tech Scoping Paper*, OHCHR B-TECH PROJECT, Nov. 2019, *available at* https://www.ohchr.org/sites/default/files/Documents/Issues/Business/B-Tech/B_Tech_Scoping_paper_takeaways_submissions_final.pdf.

[26] APPLYING THE UN GUIDING PRINCIPLES ON BUSINESS AND HUMAN RIGHTS IN TECHNOLOGY PROJECT, OHCHR B-TECH PROJECT, Nov. 2019, at 8-9, *available at* https://www.ohchr.org/sites/default/files/Documents/Issues/Business/B-Tech/B_Tech_Project_revised_scoping_final.pdf.

[27] António Guterres, OUR COMMON AGENDA, UNITED NATIONS, 2021, at 33, *available at* https://www.un.org/en/content/common-agenda-report/assets/pdf/Common_Agenda_Report_English.pdf [hereinafter OUR COMMON AGENDA].

[28] Electronics, including electronic communications systems and data storage.

device such as a smartphone.[29] Thus, BCIs can potentially allow bidirectional communication between the brain and the outside world, either by exporting brain data or by altering brain activity.[30] For instance, BCIs have helped a man who is paralyzed and non-verbal to communicate at 18 words (90 characters) per minute with up to 99 percent accuracy.[31] They can be either invasive (and be an implanted chip inside the brain) or non-invasive/non-surgical (such as a helmet).[32] Invasive BCIs require surgery to implant and are regulated as medical devices with heightened health-data protection.[33] Examples of invasive BCIs include cochlear implants; deep brain stimulators which can help people with Parkinson's disease regain mobility; brain implants which help people with missing or damaged limbs to feel heat and cold through their prostheses; and implantable brain chips developed for nonverbal individuals with Amyotrophic Lateral Sclerosis ("ALS") which enable them to fluently communicate as well as to write and send emails.[34]

Non-invasive BCIs, by contrast, are typically considered electronic consumer devices and face few regulations for data privacy or accessibility.[35] They include wearable helmets, glasses, diadems, caps, wristbands, and headbands which can read brain activity, and/or peripheral nervous system activity, by touching a person's head or body (rather than directly touching the brain). Recent examples of their use include sharing images and words between two people in different rooms, which allowed the two to communicate.[36] Non-invasive BCIs also have enabled a person who is quadriplegic to drive a Formula One race car,[37] and a person who is paraplegic to make the first kick of the World Cup using a mind-controlled robotic exoskeleton.[38] CTRL-Labs developed a wristband that may be the first consumer product to use neural activity to translate intentions, gestures, and motions into computer control of movements of a robotic avatar. And Kernel released the Flow helmet in the fall of 2020, which maps brain activity with unprecedented and detailed accuracy.[39] The Flow's breakthrough hardware could massively accelerate the development of neurotechnology with software applications that interpret the widest array of data that it captures.

In general, BCIs that can record or "read" brain activity are outpacing the development of those which can alter brain activity, or "write" to the human brain, most of which may be more than

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[29] Rafael Yuste, Jared Genser & Stephanie Herrmann, *It's Time for Neurorights: New Human Rights for the Age of Neurotechnology*, 18 HORIZONS 154, 154-55 (2021), *available at* https://www.perseus-strategies.com/wp-content/uploads/2021/03/Neuro-Rights-Horizons-Winter-2021.pdf [hereinafter HORIZONS].
[30] *Id.*, at 155.
[31] Francis R. Willett, et al., *High-Performance Brain-to-Text Communication Via Handwriting*, 593 NATURE 249-254 (2021), *available at* https://doi.org/10.1038/s41586-021-03506-2.
[32] HORIZONS, *supra* note 29, at 155.
[33] *See, e.g.*, Anna Wexler & Peter B. Reiner, *Oversight of Direct-To-Consumer Neurotechnologies*, 363 SCIENCE 234, 235 (2019); *General Wellness: Policy for Low Risk Devices*, FOOD & DRUG ADMIN., at 1–13 (2016), *available at* https://www.fda.gov/media/90652/download [hereinafter FOOD & DRUG ADMIN.].
[34] HORIZONS, *supra* note 29, at 156.
[35] *Id.*, at 157; FOOD & DRUG ADMIN., *supra* note 33.
[36] HORIZONS, *supra* note 29, at 157.
[37] *Id.*
[38] Alejandra Martins and Paul Rincon, *Paraplegic in Robotic Suit Kicks of World Cup*, BBC, June 14, 2014, *available at* https://www.bbc.com/news/science-environment-27812218.
[39] HORIZONS, *supra* note 29, at 158.

a decade away.[40] Nevertheless, BCIs' success in laboratories indicates its future potential.[41] For instance, in 2018, the MIT Media Lab used an invasive BCI to transcribe human thoughts into typed messages, reading neural signals from the wearer's brain – but not writing back to it.[42] Currently, "brain-reading" BCIs have been used for medical and for surveillance reasons.[43] At a factory in Hangzhou, China, production line workers are allegedly being outfitted with hats and helmets which read brain signals to decode workers' emotions – and then this data is fed to artificial intelligence algorithms to detect changes in emotion which affect productivity levels, but the accuracy of this technology is contested.[44]

BCIs have already been used to alter brain activity.[45] In 2019, a group of scientists conducting research in laboratory animals discovered that repeatedly stimulating certain parts of a mouse's brain could cause the mouse to behave in a predetermined way – such as repeatedly drinking – after the manipulation of its sensory experiences.[46] And potential military applications of BCIs enabling soldiers to communicate in remote locations are a hacking vulnerability which could lead to controlling others' decisions.[47] Given these examples, it is clear that neurotechnology presents not only opportunities for medicine, science, and economic development – but also brings with it unprecedented human rights concerns about free will, what it means to be human, and the privacy of our thoughts. Today, only a small amount of brain data can be meaningfully interpreted. But in the future, as technology evolves, non-invasive neurotechnology, including optical or electrical scanning of brain activity, hand in hand with AI algorithms, could reveal much more detailed information about a person's mental state or processes.

The unprecedented challenges posed by neurotechnology can and must build upon and further interpret existing international human rights for the protection of human dignity, liberty and security of the person, nondiscrimination, equal protection, and privacy. However, these are very generic terms, and the ramifications of neurotechnology require increased specificity.[48]

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[40] Ahmed Shaheed, REPORT OF THE SPECIAL RAPPORTEUR ON THE RIGHT TO FREEDOM OF RELIGION OR BELIEF, U.N. HUMAN RIGHTS COUNCIL, U.N. Doc. A/76/380, Oct. 5, 2021, at ¶ 6, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/N21/274/90/PDF/N2127490.pdf?OpenElement [hereinafter A/76/380] (explaining that neurotechnology which passively decodes thoughts is still less accurate in the real-world than has been described); P. Murali Doraiswamy, *5 Brain Technologies Which Will Shape Our Future*, WORLD ECON. FORUM, Aug. 19, 2015, *available at* https://www.weforum.org/agenda/2015/08/5-brain-technologies-future/.

[41] A/76/380, *supra* note 40, at ¶ 76.

[42] Larry Hardesty, *Computer System Transcribes Words Users "Speak Silently"*, MIT NEWS, Apr. 4, 2018, *available at* https://news.mit.edu/2018/computer-system-transcribes-words-users-speak-silently-0404.

[43] *Id.*

[44] Erin Winick, *With Brain-Scanning Hats, China Signals It Has No Interest in Workers' Privacy*, MIT TECHNOLOGY REVIEW, Apr. 30, 2018, *available at* https://www.technologyreview.com/2018/04/30/143155/with-brain-scanning-hats-china-signals-it-has-no-interest-in-workers-privacy/ [hereinafter Winick]; Samantha Cole, *China Claims It's Scanning Workers' Brainwaves to Increase Efficiency and Profits*, VICE NEWS, May 1, 2018, *available at* https://www.vice.com/en/article/8xkymg/china-brain-wave-hats-helmets-productivity [hereinafter VICE NEWS].

[45] A/76/380, *supra* note 40, at ¶ 76.

[46] Luis Carrillo-Reid, Shuting Han, Weijian Yang, et al., *Controlling Visually Guided Behavior by Holographic Recalling of Cortical Ensembles*, 178 CELL 447-457 (2019) [hereinafter Luis Carrillo-Reid, Shuting Han, Weijian Yang, et al.]; James H. Marshel, Yoon Seok Kim, Timothy A. Machado, et al., *Cortical Layer - Specific Critical Dynamics Triggering Perception*, 365 SCIENCE 558, 558 (2019) [hereinafter James H. Marshel, Yoon Seok Kim, Timothy A. Machado, et al].

[47] Anika Binnendijk, Timothy Marler & Elizabeth M. Bartels, BRAIN COMPUTER INTERFACES: U.S. MILITARY APPLICATIONS AND IMPLICATIONS, RAND CORP., 2020, at 10, *available at* https://www.rand.org/pubs/research_reports/RR2996.html [hereinafter RAND].

[48] HORIZONS, *supra* note 29, at 158.

Furthermore, a comprehensive framework developed from existing human rights treaties does not yet exist to address the wider range of conceivable current and future abuses of neurotechnology.

Terminology used and assumptions made within existing human rights treaties demonstrate how unprepared the current international human rights landscape is to confront neurotechnology. Treaties rely upon terms and concepts such as "pain," or "suffering," which will require definitional expansions. For example, the use of some neurotechnology may not be considered "painful" and may not cause lasting damage to the brain. Moreover, some treaties and their general comments rely upon assumptions such as an individual's ability to lie, which may no longer apply as neurotechnology's development continues. It is time for new leadership and for proactive global action to identify protection gaps to prevent the misuse and abuse of neurotechnology.

### *B. The Case for UN Leadership on Neurotechnology and Human Rights*

*Our Common Agenda*'s reference to neurotechnology is an unprecedented and timely development in the UN's human rights leadership on emerging technologies. In his 2020 *Call to Action for Human Rights*, Secretary-General Guterres previously stated his aim to "strengthen UN leadership in advancing the cause of human rights" by making the UN more responsive and innovative when confronting new human rights challenges.[49] His *Roadmap for Digital Cooperation* helps direct the UN's leadership efforts toward the dual imperatives to prevent technology from worsening discrimination and to promote inclusion in its use and accessibility.[50]

The outcome of these developments is a consensus both within and beyond the UN that the international human rights framework must be re-examined and brought up to date with the contemporary challenges of neurotechnology. As the High-Level Panel on Digital Cooperation has noted, "existing human rights treaties were signed in a pre-digital era."[51] Similarly, the Universal Declaration on Human Rights ("UDHR") was signed in 1948 – and the human rights landscape has evolved enormously since its adoption.[52]

Existing international human rights treaties, in their current forms, cannot provide the robust and comprehensive human rights protection that a neurotechnological world requires.[53] Simultaneously, there is a lack of global consensus on how to identify and define the potential human rights abuses which neurotechnology may cause. Some organizations have begun to address the challenges of neurotechnology through regional ethical frameworks, but these are highly decentralized and do not directly draw upon international human rights law.

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[49] António Guterres, THE HIGHEST ASPIRATION: A CALL TO ACTION FOR HUMAN RIGHTS, UNITED NATIONS, 2020, at 3, *available at* https://www.un.org/sg/sites/www.un.org.sg/files/atoms/files/The_Highest_Asperation_A_Call_To_Action_For_Human_Right_English.pdf [hereinafter CALL TO ACTION].
[50] *Id.*, at 12.
[51] REPORT OF THE SECRETARY-GENERAL, ROADMAP FOR DIGITAL COOPERATION: IMPLEMENTATION OF THE RECOMMENDATION OF THE HIGH-LEVEL PANEL ON DIGITAL COOPERATION, UNITED NATIONS GENERAL ASSEMBLY, U.N. Doc. No. A/74/281, May 29, 2020, at ¶ 38, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/N20/102/51/PDF/N2010251.pdf?OpenElement [hereinafter ROADMAP FOR DIGITAL COOPERATION].
[52] HORIZONS, *supra* note 29, at 154.
[53] *Id.*

These frameworks include the OECD Recommendations on Responsible Innovation in Neurotechnology, the Declaration of the Inter-American Juridical Committee on Neuroscience, Neurotechnologies, and Human Rights, the Tshwane Principles on National Security and the Right to Information, and the NIH Neuroethics Guiding Principles for the U.S. BRAIN Initiative.[54] While each agreement addresses concerns of safety, consent, and privacy issues, they individually fail to address the dangers of algorithmic bias, state responsibilities and duties, or additional human rights which may be infringed upon through neurotechnology, such as the rights to freedom of thought, freedom from slavery, and freedom from torture. Additionally, the definitions of both neurotechnology and of identified neurorights, such as the right to identity, differ for each framework. The international community would benefit greatly from UN engagement that generates a global set of definitions for States to use in their domestic legal and regulatory systems.

Moreover, some international tools that are relevant to neurotechnology are nonbinding or declaratory instruments. They do not provide binding law concerning human rights and neurotechnology but are instead a set of recommendations. For instance, the UN Principles of Medical Ethics relevant to the Role of Health Personnel, particularly Physicians, in the Protection of Prisoners and Detainees against Torture and Cruel, Inhuman or Degrading Treatment or Punishment address the duties of physicians to protect prisoners and detainees by providing quality physical and mental health care and to prevent torture.[55] Although the prohibition on torture is considered customary international law,[56] this instrument is a nonbinding General Assembly resolution and provides no specificity about preventing the misuse or abuse of neurotechnology in detention centers and prisons.

Protection gaps under international human rights law might be partially addressed by incorporating the language of declaratory instruments into treaties' general comments. The UNESCO International Declaration on Human Genetic Data, for instance, does not provide any specific references to existing human rights treaties, but it creates guidelines for the collection and storage of genetic data[57] which may apply to brain data. Likewise, the UNESCO Universal Declaration on Bioethics and Human Rights discusses that autonomy and informed consent are critical to ethical treatment.[58] Although the declaration's scope concerns medicine, life sciences, and associated technologies, its standards also may be applied to protect user data in consumer neurotechnology. Alternatively, new language must emerge where existing instruments do not provide relevant language. For example, the UN's Data Privacy Guidelines in the Age of Artificial Intelligence simply would not apply to States' misuse or abuse of technology which can read and

[54] OECD/LEGAL/0457, *supra* note 1; DECLARATION OF THE INTER-AMERICAN JURIDICAL COMMITTEE, *supra* note 2; TSHWANE PRINCIPLES, *supra* note 3; *Guiding Principles for NIH BRAIN Initiative*, *supra* note 4.
[55] Principles of Medical Ethics relevant to the Role of Health Personnel, particularly Physicians, in the Protection of Prisoners and Detainees against Torture and Cruel, Inhuman or Degrading Treatment or Punishment, G.A. Res. 37/194, *adopted* Dec. 18, 1982, at Principles 1 and 2 [hereinafter Principles of Medical Ethics].
[56] *General Comment No. 2*, U.N. COMM. AGAINST TORTURE, U.N. Doc. CAT/C/GC/2, Jan. 24, 2008, at ¶ 2, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/G08/402/62/PDF/G0840262.pdf?OpenElement [hereinafter CAT/C/GC/2].
[57] *International Declaration on Human Genetic Data*, UNESCO, *adopted* Oct. 16, 2003, at Art. 16(b), *available at* http://portal.unesco.org/en/ev.php-URL_ID=17720&URL_DO=DO_TOPIC&URL_SECTION=201.html.
[58] *Universal Declaration on Bioethics and Human Rights, 33rd sess.*, UNESCO, Oct. 19, 2005, *available at* http://portal.unesco.org/en/ev.php-URL_ID=31058&URL_DO=DO_TOPIC&URL_SECTION=201.html.

write to the human brain, but current modalities of data protection – such as encryption – may effectively protect privacy and should be recommended for BCI data transfers.[59]

Domestic developments in Spain and Chile have sparked the creation of additional decentralized guardrails for neurotechnology. In July 2021, Spain adopted its Charter on Digital Rights, which references both "digital rights in the use of neurotechnologies," and the importance of mental agency, privacy, and non-discrimination.[60] Independently, in October 2021, Chile amended its Constitution to require protecting brain data and that such data be regulated and processed by a government agency.[61] An accompanying bill of law has been approved by the Senate to provide detailed legal protection for neurorights by regulating all neurotechnology as medical devices. Both actions spurred the Inter-American Juridical Committee to create its own set of ethical guardrails for protecting human rights in the age of neurotechnology.[62] But even as regional frameworks evolve, there is no consensus view for describing the human rights protection gaps that are unique to neurotechnology, such as the potential abuse of brain-reading BCIs to undermine the presumption of innocence.

Even existing human rights treaties fail to address these gaps. But, in some cases, they provide something which regional frameworks do not – optional protocols allowing UN human rights bodies to receive and consider individual communications. By identifying protection gaps, this report builds upon the existing UN human rights system to allow individuals to complain and receive justice when States violate their human rights through the misuse and abuse of neurotechnology. Therefore, highlighting and seeking to fill gaps under existing treaties is a critical first step toward human rights protection in the age of neurotechnology.

The UN is best positioned of any international organization to generate momentum for protecting human rights in the age of neurotechnology. Following its engagement of senior UN officials, the Neurorights Foundation proposed to analyze the ways in which existing international treaties fail to address novel human rights challenges in the neurotechnological age, or "neurorights." The Secretary-General's office can easily convene individuals with expertise in both neurotechnology and international human rights law more readily than its individual partners. By collaborating across the UN, with its key partners, the Office of the High Commissioner for Human Rights and the UNESCO Bioethics Committee, as well as with outside expert NGOs like the

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[59] *See* REPORT OF THE HIGH COMMISSIONER FOR HUMAN RIGHTS, THE RIGHT TO PRIVACY IN THE DIGITAL AGE, U.N. Doc. A/HRC/48/31, Sept. 13, 2021, at ¶¶ 15-18, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/G21/249/21/PDF/G2124921.pdf?OpenElement (discussing how artificial intelligence infringes upon the human right to privacy through the collection and storage of sensitive data, and through algorithms which can predict human behavior or discern political beliefs, but failing to address how neurotechnology could directly expose an individual's political beliefs by reading his or her thoughts in the near future) [hereinafter A/HRC/48/31]; *Data Privacy Guidelines in Context of Artificial Intelligence*, U.N. HUMAN RIGHTS COUNCIL, *accessed* Nov. 17, 2021, *available at* https://www.ohchr.org/EN/Issues/Privacy/SR/Pages/CFI_data_privacy_guidelines.aspx.

[60] LA MONCLOA, *The Government Adopts Digital Rights Charter to Articulate a Reference Framework to Guarantee Citizens' Rights in the Digital Age*, GOVERNMENT OF SPAIN, July 14, 2021, *available at* https://www.lamoncloa.gob.es/lang/en/gobierno/news/Paginas/2021/20210713_rights-charter.aspx.

[61] *Milestones*, THE NEURORIGHTS FOUNDATION, *last updated* Oct. 25, 2021, *available at* https://neurorightsfoundation.org/chile; General Norms CVE 2031873 of the Republic of Chile**,** Law No. 21.383, Oct. 25, 2021, *available at* https://static1.squarespace.com/static/60e5c0c4c4f37276f4d458cf/t/6182c0a561dfa17d0ca34888/1635958949324/English+translation.pdf.

[62] DECLARATION OF THE INTER-AMERICAN JURIDICAL COMMITTEE, *supra* note 2.

Neurorights Foundation, the Secretary-General's office can help facilitate the development of unifying global standards for human rights and neurotechnology.

## METHODOLOGY

*International Human Rights Protection Gaps in the Age of Neurotechnology* examines the following treaties and analyzes their potential to protect against conceivable misuse and abuse of neurotechnology. Using existing human rights treaties to examine the potential misuse and abuse of neurotechnology efficiently uses the machinery of the UN human rights system to collect, clarify, and explain States' already legally binding obligations. The treaties listed below are addressed in order of their relevance to human rights and neurotechnology. Each chapter addresses a different treaty.

Chapter I: International Covenant on Civil and Political Rights, 1966 ("ICCPR")
Chapter II: Convention Against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment, 1984 ("CAT")
Chapter III: International Covenant on Economic, Social and Cultural Rights, 1966 ("ICESCR")
Chapter IV: Convention on the Rights of Persons with Disabilities, 2006 ("CRPD")
Chapter V: International Convention on the Elimination of All Forms of Racial Discrimination, 1965 ("CERD")
Chapter VI: Convention on the Elimination of All Forms of Discrimination Against Women, 1979 ("CEDAW")
Chapter VII: Convention on the Rights of the Child, 1989 ("CRC")

### *A. Structure of Analysis*

Each chapter discusses an international human rights treaty from two perspectives. The first perspective analyzes how the treaty applies to a set of five ethical issue areas, or "neurorights," associated with neurotechnology. Prominent neuroscientists and neuroethicists developed these five neurorights to address the potential misuse and abuse of currently available neurotechnology and that which will be available in the foreseeable future.[63] The five neurorights include (1) the right to identity (sense of self), (2) the right to agency (free will), (3) the right to mental privacy (protection of private thoughts against disclosure), (4) the right to fair access to mental augmentation, and (5) the right to protection from algorithmic bias.[64]

*International Human Rights Protection Gaps in the Age of Neurotechnology* approaches the protection of mental privacy by recommending that actions which infringe it, such as the monitoring and interpretation of individuals' brain activity without their consent or knowledge or without the consent of their legal guardian, are contrary to international human rights law. The right to mental privacy is absolute, and any interference with it by States without consent should be considered *de facto* cruel, inhuman, or degrading treatment, as discussed in Chapter II. Interferences with the neurorights of children are impermissible unless the child's parent or legal guardian provides informed consent – and even with adequate consent, such interferences still must comply with other provisions of international human rights law, as discussed in Chapter III.

[63] Ienca & Andorno, *supra* note 14.
[64] *Four Ethical Priorities*, *supra* note 14.

The people who first coined the term neurorights are leaders and members of the Morningside Group, a group of 25 neuroscientists, neurotechnologists, clinicians, ethicists, and machine-intelligence engineers representing major neurotechnology companies, including Google and Kernel, and seven countries – including representatives of the world's International BRAIN Initiatives – the U.S., Canada, Europe, Israel, China, Japan, and Australia.[65] The Morningside Group developed the neurorights to fill a "deficit" in international frameworks for technology and science ethics to protect against the misuse and abuse of neurotechnology.[66] A similar proposal was independently made by scholars Marcello Ienca and Roberto Andorno, who focused upon mental privacy, psychological continuity, and decision-making.[67] Neurorights have already gained some conceptual recognition in the OECD Guidelines for the Responsible Innovation in Neurotechnology, the UNESCO Declaration on Bioethics and Human Rights, the Declaration of the Inter-American Juridical Committee, the laws of Chile and Spain, and the UNESCO International Bioethics Committee's report, and they are under consideration by the Council of Europe. Thus, neurorights are both a burgeoning concept and a useful way to describe where current treaties fall short in protecting human rights against the misuse and abuses of neurotechnology.

However, the analysis of each treaty is not limited to these proposed neurorights. The second perspective examines the articles of the international human rights treaties to ascertain whether their provisions readily apply to the potential misuse and abuse of neurotechnology that is not covered by the proposed neurorights. In so doing, each chapter examines articles of the treaty, its related general comments or recommendations and jurisprudence, and the reports of relevant UN Special Procedures. From this examination, each chapter identifies potential misuse and abuse of neurotechnology relating to a specific treaty, such as potential interference with the right to freedom of opinion and expression.

### *B. Application of Analysis*

Using both perspectives, the chapters then identify articles of each international human rights treaty which: (A) arguably already protect neurorights or against other potential misuse and abuse of neurotechnology, (B) articles which could be further interpreted for protection, and (C) articles which provide inadequate protection.

Additionally, each chapter discusses the greatest risk that the treaty poses to neurorights, or in other words, its greatest protection gap – and provides examples of existing and future neurotechnology that may be misused or abused to illustrate the importance of closing that gap.

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[65] *Id.*

[66] *Id.* The Morningside Group believes that the neurorights address protection deficits in the following international frameworks: The Declaration of Helsinki; a statement of ethical principles first established in 1964 for medical research involving human subjects; the Belmont Report, a 1979 statement crafted by the US National Commission for the Protection of Human Subjects of Biomedical and Behavioural Research; and the Asilomar Artificial Intelligence (AI) Statement of Cautionary Principles, published early this year and signed by business leaders and AI researchers, among others.

[67] Ienca & Andorno, *supra* note 14.

## I. THE INTERNATIONAL COVENANT ON CIVIL AND POLITICAL RIGHTS

The International Covenant on Civil and Political Rights ("ICCPR") entered into force in 1976 and protects inalienable rights derived from inherent human dignity.[68] The ICCPR has an Optional Protocol enabling the Human Rights Committee to receive and consider individual communications.[69] **Currently, none of the ICCPR's articles, general comments, or associated jurisprudence mention neurotechnology.** However, many of its articles and general comments may be further interpreted to protect against the potential misuse and abuse of neurotechnology. For example, Article 7 stipulates that "no one shall be subjected without his free consent to medical or scientific experimentation,"[70] which should protect individuals from experimentation using BCIs. Furthermore, many terms and concepts contained within the ICCPR readily apply to neurorights, such as self-determination.[71]

The Human Rights Committee's general comments do not explicitly mention neurotechnology. However, they do address other forms of technology, including, notably, digital technologies.[72] Reports by the various UN Special Rapporteurs of the UN Human Rights Council further interpret the general comments to encapsulate potential misuse and abuse of both AI and digital technologies.[73] Special Rapporteurs have discussed "forced neurological interventions,"[74] but those are discussed within the context of forced indoctrination programs – not with respect to technological development. The Human Rights Committee's jurisprudence does not mention neurotechnology,[75] and the same is true for communications of the Special Rapporteurs, but prior communications have raised human rights concerns associated with digital technologies, such as electronic communication and surveillance.[76]

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[68] International Covenant on Civil and Political Rights, 999 U.N.T.S. 171, *entered into force* Mar. 23, 1976 [hereinafter ICCPR].

[69] Optional Protocol to the International Covenant on Civil and Political Rights, G.A. Res. 2200A (XXI), *entered into force* Mar. 23, 1976, at Art. 1.

[70] ICCPR, *supra* note 68, at Art. 7.

[71] *Id.*, at Art. 1(1).

[72] *General Comment No. 16 on Article 17*, U.N. HUMAN RIGHTS COMM., U.N. Doc. CCPR/C/GC/16, Apr. 8, 1988, at ¶ 10, *available at* https://www.refworld.org/docid/453883f922.html.

[73] *See, e.g.*, REPORT OF THE SPECIAL RAPPORTEUR ON THE RIGHT TO PRIVACY, U.N. HUMAN RIGHTS COUNCIL, U.N. Doc. A/HRC/43/52, Mar. 24, 2020, at ¶ 45, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/G20/071/66/PDF/G2007166.pdf?OpenElement; David Kaye, REPORT OF THE SPECIAL RAPPORTEUR ON THE PROMOTION AND PROTECTION OF THE RIGHT TO FREEDOM OF OPINION AND EXPRESSION, U.N. HUMAN RIGHTS COUNCIL, U.N. Doc. A/73/348, Aug. 29, 2018, at ¶¶ 23-24, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/N18/270/42/PDF/N1827042.pdf?OpenElement [hereinafter A/73/348].

[74] A/73/348, *supra* note 73, at ¶ 23.

[75] It should also be noted that the Human Rights Committee's jurisprudence does not mention artificial intelligence, either. The only cases generated with the search term "artificial intelligence" concerned artificial ventilation or artificial light in prison cells. The search term "algorithm" likewise failed to generate results from the Human Rights Committee. The closest match for a neurotechnology concept is *Vandom v. Republic of Korea*, Communication No. 2273/2013, U.N. Doc. CCPR/C/123/D/2273/2013, HUMAN RIGHTS COMMITTEE, *adopted* Aug. 10, 2018, at ¶ 5.4, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/G18/245/82/PDF/G1824582.pdf?OpenElement (discussing that health data privacy protections must meet certain specifications under the ICCPR).

[76] *See, e.g.*, *Communication of the Special Rapporteurs on Promotion of Human Rights and Fundamental Freedoms While Countering Terrorism, Freedom of Opinion and Expression, Peaceful Assembly and Association, Minority Issues, and Freedom of Religion or Belief to the Government of Austria*, OL AUT 2/2021, Aug. 24, 2021, *available at* https://spcommreports.ohchr.org/TMResultsBase/DownLoadPublicCommunicationFile?gId=26590; *Communication of the Special Rapporteur on the Right to Privacy to the Government of India*, OL IND

The Special Rapporteur on Freedom of Religion or Belief has directly discussed neurotechnology and has discussed the freedom of thought in terms of "major developments in digital technology, neuroscience and cognitive psychology that could potentially enable access to the very content of our thoughts and affect how we think, feel and behave."[77]

Although the human rights concerns associated with AI and digital technologies also may apply to neurotechnology, the ICCPR is ultimately unprepared to protect neurorights and against all conceivable misuse and abuse of neurotechnology. For instance, the ethics and regulation of neurotechnology will have a strong cultural component, since privacy and agency are more valued in some cultures – and these concerns do not arise in the same way for AI and digital technologies, which do not directly interact with the human brain.[78]

The foundation laid by these Special Rapporteurs' reports, combined with the general comments and neurorights, demonstrates how the ICCPR may be more expansively interpreted to close protection gaps. This could include human rights concerns associated with neurotechnology, including agency, identity, and mental privacy. However, the ICCPR still does not meaningfully address the concerns of equal access to mental augmentation or protection from algorithmic bias.

### *A. Articles which protect against most misuse and abuse of neurotechnology*

Only two articles of the ICCPR, when read together, presently offer protection against the misuse and abuse of neurotechnology as contemplated by the neurorights framework. These are **Articles 1(1) and 2** of the treaty. Article 1(1) protects the right of individuals to self-determination, which allows them to "freely pursue their economic, social and cultural development."[79] Article 2 states that "Each State Party to the present Covenant undertakes to respect and to ensure to all individuals within its territory and subject to its jurisdiction the rights recognized in the present Covenant, without distinction of any kind, such as race, color, sex, language, religion, political or other opinion, national or social origin, property, birth or other status."[80]

The right to self-determination most closely corresponds to the neurorights of identity and agency, or more broadly, an individual's sense of self and free will. Self-determination entails, *inter alia*, the right of people to freely dispose of their natural wealth.[81] Technologies which disrupt the sense of self or interfere with individuals' ability to make decisions of their own volition clearly violate the right to self-determination. Further, deep-brain stimulation through implanted electrodes can alter a person's sense of agency and identity. In a 2016 study, a man who had used an

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24/2018, Nov. 12, 2018, *available at* https://spcommreports.ohchr.org/TMResultsBase/DownLoadPublicCommunicationFile?gId=24201 (discussing a new bill which would store personal data from electronic communications).

[77] A/76/380, *supra* note 40, at ¶ 6.

[78] *Four Ethical Priorities*, *supra* note 14, at 162.

[79] ICCPR, *supra* note 68, at Art. 1(1). Note that this article is the same as the first article in the International Covenant on Economic, Social, and Cultural Rights and will only be discussed in this chapter.

[80] *Id.*, at Art. 2.

[81] *General Comment No. 12 on Article 1*, U.N. HUMAN RIGHTS COMM., U.N. Doc. HRI/GEN/1/Rev.9 (Vol. I), Mar. 13, 1984, at ¶¶ 5-6, *available at* https://www.refworld.org/docid/453883f822.html.

implanted electrode to treat his depression for seven years reported that the way in which he interacted with others changed – and disrupted his sense of who he is.[82]

As neurotechnology continues to develop and affects behavior, people could behave in ways that they "struggle to claim as their own."[83] And a technology which disrupts psychological continuity, or consciousness and sentience, also clearly affects individuals' abilities to make their own decisions. An example would be neurotechnology which alters brain activity such that an individual in the future would no longer be in control of his or her own thoughts. Taken together with Article 2, which prohibits discrimination in the protection of individual rights, all five neurorights are implicitly addressed – a prohibition on discrimination could protect individuals against algorithmic bias and fair access concerns.

### *B. Articles which could be further interpreted to protect against misuse and abuse of neurotechnology*

The Human Rights Committee should consider further interpretation of Articles 7, 8, 9, 14, 17, 18, and 19 to protect against the misuse and abuse of neurotechnology.

**Article 7** provides that "No one shall be subjected to torture or to cruel, inhuman or degrading treatment or punishment. In particular, no one shall be subjected without his free consent to medical or scientific experimentation."[84] With meaningful expansion in a general comment, Article 7 could offer far more robust protection for the neurorights of identity, agency/free will, and mental privacy, or lack of informed consent to medical treatment or experimentation. Because torture and cruel, inhuman, or degrading treatment is discussed in greater detail in Chapter II, this chapter focuses upon Article 7's prohibition of nonconsensual experimentation, which, in principle, enables an individual to object to the experimental use of neurotechnology.

With respect to nonconsensual experimentation, the Human Rights Committee has observed:

> More attention should be given to the need and means to ensure observance of this provision. The Committee also observes that special protection in regard to such experiments is necessary in the case of persons not capable of giving valid consent, and in particular those under any form of detention or imprisonment. Such persons should not be subjected to any medical or scientific experimentation that may be detrimental to their health.[85]

Article 7 cannot protect individuals against brain-reading neurotechnology unless the technology is used for the purpose of medical or scientific experimentation, or if its use amounts to torture or cruel, inhuman, or degrading treatment. Additionally, from the way the Article 7 general comment is written above, neurotechnology used against individuals for purposes other than medical treatment or experimentation would not necessarily require informed consent to comply with the

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[82] *Four Ethical Priorities, supra* note 14; Klein, E. et al. *Brain-Computer Interface-Based Control of Closed-Loop Brain Stimulation: Attitudes and Ethical Considerations*, 3 BRAIN COMPUTER INTERFACES 140–148 (2016).
[83] *Four Ethical Priorities, supra* note 14.
[84] ICCPR, *supra* note 68, at Art. 7.
[85] *General Comment No. 20 on Article 7*, U.N. HUMAN RIGHTS COMM., U.N. Doc. CCPR/C/GC/20, Mar. 10, 1992, at ¶ 7, *available at* https://www.refworld.org/docid/453883fb0.html.

ICCPR. For example, neurotechnology used for polygraph purposes or to corroborate an individual's emotional state or trauma level should still require informed consent under international law to protect agency, identity, and mental privacy.

Thus, the Human Rights Committee should consider further interpretation of the general comment to Article 7. In the age of neurotechnology, it could include a requirement that individuals be informed that their brain data will be collected in any experimental setting (perhaps broadly defined by the setting's purpose, *i.e.*, when a State is monitoring the population), or if their brain data will be *used* for any analysis or experimentation. Such a step could help protect mental privacy and free will by providing individuals an opportunity to either object to the use of a BCI or to provide meaningful, informed consent.

**Article 8(3)(a)** provides that "No one shall be required to perform forced or compulsory labor."[86] However, Article 8(3)(a) "shall not be held to preclude, in countries where imprisonment with hard labour may be imposed as a punishment for a crime, the performance of hard labour in pursuance of a sentence to such punishment by a competent court."[87]

If a person lacks agency due to a brain activity altering BCI, that person is vulnerable to compulsory labor. Moreover, under this latter provision, an individual forced to wear such a BCI could still be legally sentenced to the performance of hard labor by a competent court. The Human Rights Committee has not yet drafted a general comment on Article 8 but should consider drafting one to help protect individuals' freedom from slavery, agency, and identity in the age of neurotechnology. A future general comment could specify that a competent tribunal sentencing an individual to the performance of hard labor will violate the prohibition on slavery if the sentenced individual is forced to perform the labor under the influence of technology which alters his agency or identity, including BCIs.

**Article 9(1)** of the ICCPR stipulates that "Everyone has the right to liberty and security of person. No one shall be subjected to arbitrary arrest or detention. No one shall be deprived of his liberty except on such grounds and in accordance with such procedures as are established by law."[88] Within the context of enhanced capabilities for law enforcement, arrests still must be predictable, appropriate, justifiable, necessary, and proportionate,[89] even in the age of AI and neurotechnology.

Article 9(1) protects the liberty and security of the person and governs the conditions which must be met to permit deprivations of this right. Its current provisions do not protect against the misuse and abuse of neurotechnology, because the Human Rights Committee has interpreted "liberty of person" to narrowly apply to confinement of the body, such as in detention.[90] Liberty of the person does not appear to contemplate being trapped within one's own body by an invasive or non-invasive BCI which alters human behavior or decision-making. For instance, in 2019, a group of scientists discovered that by recording brain activity in mice and by stimulating portions of their

[86] ICCPR, *supra* note 68, at Art. 8(3)(a).
[87] *Id.*, at Art. 8(3)(b).
[88] *Id.*, at Art. 9(1).
[89] *General Comment No. 35 on Article 9*, U.N. HUMAN RIGHTS COMM., U.N. Doc. CCPR/C/GC/35, Dec. 16, 2014, at ¶ 11, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/G14/244/51/PDF/G1424451.pdf?OpenElement.
[90] *Id.*, at ¶ 3.

brains, the scientists could force the mice to behave in a predetermined way.[91] Although this technology will not be present in humans for many years, if abused by law enforcement, such neurotechnology could deprive individuals of their liberty – agency, identity, and mental privacy – and use their own minds to confine them against their will.

"Security of person" also is narrowly interpreted – it concerns "freedom from injury to the body and the mind, or bodily and mental integrity."[92] Where the use of a non-invasive BCI is painless, its subject is unaware of its existence, or it does not cause lasting damage to the mind, it is unclear whether Article 9 offers human rights protection. The Article 7 prohibition on nonconsensual experimentation may instead apply, but if the neurotechnology is used for a purpose other than experimentation, the circumstances under which it interferes with security of the person are murky. The Human Rights Committee should consider reimagining the general comment to Article 9 to reflect new ways in which neurotechnology could confine and injure individuals.

Specifically, the general comment to Article 9 could redefine mental integrity. The extraction of an individual's private thoughts violates a person's mental privacy (or the protection of thoughts against disclosure), but mental privacy and mental integrity are not used interchangeably in the ICCPR's general comments. It remains questionable whether extracting a person's private thoughts, if they are relevant to a judicial process and done through protected modalities, would violate mental integrity. Yet, mind-reading technology, which translates the words that people with ALS are thinking fluently into text or speech, already exists. It is expected that wearable BCIs that perform the same function will be available within a few years.

Under Article 9's current provisions, the use of a non-invasive BCI to observe and record a detainee's brain activity, such as to verify guilt or innocence by triggering the detainee's instant recall, may not violate mental "liberty and security" so long as there is no injury. Particularly where neurotechnology can read all brain activity, the State will have unfettered access to detainees' and suspects' brains, likely resulting in excessive pretrial detention and numerous due process violations.

**Article 9(3)** prohibits excessive pretrial detention: "It shall not be the general rule that persons awaiting trial shall be detained in custody."[93] This requirement of Article 9 is under threat in the age of neurotechnology. Where individuals are detained either pending the investigation of their brain scans as law enforcement attempts to determine their guilt or innocence, they may suffer in excessive pretrial detention. Today, it is possible to interpret only a small amount of data in an EEG – but that number will increase. One study has already reported 91% accuracy in using EEGs to predict, for example, suicidal thoughts.[94] Even so, interpreting an EEG may take a long time; leaving detainees to wait until law enforcement has fully decoded their brain scan.

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[91] Luis Carrillo-Reid, Shuting Han, Weijian Yang, et al., *supra* note 46; James H. Marshel, Yoon Seok Kim, Timothy A. Machado, et al., *supra* note 46.
[92] *General Comment No. 35 on Article 9*, *supra* note 89, at ¶ 11; *see Wackenheim v. France*, Communication No. 854/1999, U.N. Doc CCPR/C/75/D/854/1999, July 15, 2002, U.N. HUMAN RIGHTS COMM., at ¶ 6.3, *available at* http://hrlibrary.umn.edu/undocs/854-1999.html.
[93] ICCPR, *supra* note 68, at Art. 9(3).
[94] Marcel Just, Lisa Pan & Vladimir Cherkassy, et al., *Machine Learning of Neural Representations of Suicide and Emotion Concepts Identifies Suicidal Youth*, NATURE HUMAN BEHAVIOR, 2017, *available at* https://nocklab.fas.harvard.edu/files/nocklab/files/just_2017_machlearn_suicide_emotion_youth.pdf.

**Article 14(1)** states that "All persons shall be equal before the courts and tribunals. In the determination of any criminal charge against him, or of his rights and obligations in a suit at law, everyone shall be entitled to a fair and public hearing by a competent, independent and impartial tribunal established by law."[95] This right includes the presumption of innocence, as well as to equal treatment in proceedings without any discrimination.[96]

Individuals before the courts, as well as criminal suspects and detainees, should not be subject to non-consensual neurological data collection except under the narrowest circumstances, which must be regulated by law.[97] Using neurotechnology in forensic analysis can interfere with due process rights because it may undermine the presumption of innocence. As previously noted, the ability to decode individuals' thoughts from their brain activity is likely to develop within the next several years. For example, Facebook has worked to make this technology non-invasive and available to consumers.[98] Law enforcement, equipped with non-invasive BCIs to use on criminal suspects or pre-trial detainees, could violate the presumption of innocence by translating individuals' thoughts before trial and determining which crimes will be charged. Suspects are more likely to be indicted if the indicting authority was provided access to a person's private thoughts when being questioned wearing a BCI.

Not only are there staggering ethical implications for due process rights, but there is a risk of racial bias affecting both (1) who is asked or forced to wear a brain-reading BCI before a court or tribunal in determining the charges against him, and (2) how the data from brain-reading BCIs is interpreted. An algorithm might contain biases from its human programmers or learn them over time – and, due to racial bias, the brain activity of members of one group may "trend" toward guilty rather than innocent.

**Article 17** governs the right to privacy. It states that "No one shall be subjected to arbitrary or unlawful interference with his privacy, family, home or correspondence, nor to unlawful attacks on his honor and reputation,"[99] and that "everyone has the right to the protection of the law against such interference or attacks."[100] Article 17's accompanying general comment clarifies that it protects individuals from attacks by the State and from natural or legal persons (such as private citizens or corporations).[101] This is a critical step in protecting neurorights, since it is primarily companies who will distribute consumer neurotechnology. From the perspective of neurorights, mental privacy must be protected against disclosure. From the perspective of additional,

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[95] ICCPR, *supra* note 68, at Art. 14(1).
[96] *General Comment No. 32 on Article 14*, U.N. HUMAN RIGHTS COMM., U.N. Doc. CCPR/C/GC/32, Aug. 23, 2007, at ¶¶ 6, 8, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/G07/437/71/PDF/G0743771.pdf?OpenElement.
[97] The law of polygraph tests in different countries may be instructive to the Human Rights Committee on this point. In the U.S., courts have found that employers and law enforcement can require individuals, including employees and individuals on parole, to submit to polygraph tests in limited circumstances. *See, e.g.*, *Zacadi v. Zale Corp.,* 856 F.2d 1473 (10th Cir. 1988); *Long Beach City Emp. Ass'n v. City of Long Beach*, 719 P.2d 660 (Cal. 1986); *People v. Miller*, 256 Cal.Rptr. 587 (Cal. Ct. App. 1989).
[98] Inverse, *Regina Dugan's Keynote at Facebook F8 2017*, Apr. 20, 2017, *available at* https://www.youtube.com/watch?v=kCDWKdmwhUI&ab_channel=Inverse; Sigal Samuel, *Facebook is Building Tech to Read Your Mind. The Ethical Implications are Staggering*, VOX, Aug. 5, 2019, *available at* https://www.vox.com/future-perfect/2019/8/5/20750259/facebook-ai-mind-reading-brain-computerinterface.
[99] ICCPR, *supra* note 68, at Art. 17(1).
[100] *Id.*, at Art. 17(2).
[101] *General Comment No. 16 on Article 17*, *supra* note 72, at ¶ 1.

conceivable abuses of neurotechnology, personal brain data (whether in reading or writing form) must be protected in its collection, storage, and transfer to third parties.

Interference with an individual's right to privacy is permissible only if it is neither arbitrary nor unlawful.[102] A State's interference with the right to privacy is only lawful if it complies with the ICCPR and is not arbitrary only if it complies with the provisions, aims, and objectives of the ICCPR and is "proportional to the end sought and be necessary in the circumstances of any given case."[103] Devices which one day might enable surveillance of individuals' brain activity *en masse* would likely be arbitrary because they are neither (1) "the least intrusive instrument amongst those which might achieve the desired result,"[104] nor (2) necessary to protect against a risk for which the right to privacy was originally restricted.[105] But a variety of neurotechnology devices may be used for surveillance purposes. For instance, neurotechnology devices which track emotional changes will be considered less intrusive than invasive BCIs – and this distinction requires clarity to protect mental privacy and against discrimination.

There is tension between AI and neurotechnology in the Special Rapporteur on the Right to Privacy's analysis of human rights in the digital age. The Special Rapporteur notes that the "inherent opacity of AI-based decisions raises particularly pressing questions concerning State accountability when AI informs coercive measures."[106] However, the danger of brain-reading BCIs resides not within their opacity, but within their potential in the coming years to totally expose a person's private thoughts. State accountability is differently at issue for neurotechnology compared to AI, because of BCIs' potential for total transparency, and consequently, due process and privacy violations if States abuse these devices (accountability also is at issue in a conflict zone – *see* Section C, below).

Therefore, precise ethical guidelines which apply to AI the nuances of neurotechnology may help define State accountability where AI is combined with neurotechnology. To develop guidelines, the UN human rights bodies should consider conceptualizing State accountability amongst different emerging technologies and highlight examples in which States are accountable for the indirect actions of technology (such as machine-learning BCIs) and examples in which States are directly accountable (such as invasive BCIs). Additionally, using BCI examples to model State accountability would helpfully clarify key differences between neurotechnology and AI.

Another protection gap is that Article 17 protects against the unlawful disclosure of personal information[107] but does not adequately protect mental privacy against the disclosure of brain data. The jurisprudence of the Human Rights Committee does not limit the definition of a lawful disclosure to *relevant* information, and therefore, it does not address scenarios where the total information in a lawful disclosure is presently unknown. For instance, only a small percentage of

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[102] REPORT OF THE SPECIAL RAPPORTEUR ON THE RIGHT TO PRIVACY, U.N. Doc. A/HRC/27/37, June 30, 2014, at ¶¶ 21-27, *available at* https://www.ohchr.org/EN/HRBodies/HRC/RegularSessions/Session27/Documents/A.HRC.27.37_en.pdf.
[103] *Id.*, at ¶ 21.
[104] *Id.*, at ¶ 25.
[105] *Id.*
[106] A/HRC/48/31, *supra* note 59, at ¶ 24.
[107] *See IP v. Finland*, Communication No. 450/1991, U.N. Doc CCPR/C/48/D/450/1991, July 26, 1993, U.N. HUMAN RIGHTS COMM., at ¶ 6.3, *available at* http://hrlibrary.umn.edu/undocs/html/450-1991.html (finding that because disclosure of tax information as lawful under existing regulations, the complaint was inadmissible as to Article 17).

an EEG can be interpreted today, but that portion is expected to increase. If an EEG is collected and stored over time by a government agency and is later disclosed, the agency will potentially reveal more information than it initially intended to collect. Inevitably, the EEG will disclose some brain data which is irrelevant to the disclosure's purpose.

Article 17 also protects the secure storage of individuals' personal information but does not specifically account for brain data. To conform with the ICCPR's requirements, "the gathering and holding of personal information on computers, data banks and other devices, whether by public authorities or private individuals . . . must be regulated by law."[108] States must take effective measures to ensure that information concerning a person's private life does not reach persons who are not authorized to receive it.[109] Today, there are few regulations restricting the sale and access of brain data. As discussed in the introduction, only Chile and Spain have domestic laws which touch upon the processing of brain data. The Human Rights Committee should consider strengthening the neurorights protection of Article 17 by incorporating into its general comment examples of how States can comply with its requirements, such as limiting the sharing of brain data to specific circumstances or by creating requirements for domestic data processors.

For example, the General Data Protection Regulation ("GDPR") helps enforce the "right to be forgotten" under European regional human rights law.[110] But this right is not absolute. If a person's data is required for legitimate business purposes, a company may retain it.[111] In the age of neurotechnology, retaining a person's EEG or other brain data could violate his or her right to mental privacy. Today, it is unknown how much brain data will be deciphered from EEGs in the future, and if a company stores an EEG for its legitimate business purposes, it can retain unknown quantities of personal data.

The Special Rapporteur on the Right to Privacy has similarly expressed a need for oversight in data transfers,[112] particularly for intelligence and health-related data. The Special Rapporteur established a Task Force in 2017 on the Privacy and Protection of Health-Related Data, which created a set of guidelines for health-data processing which comply with Article 17, and which may apply to new technologies.[113] Incorporating these guidelines into the general comment on Article 17 could provide invaluable regulatory instructions to States in protecting mental privacy.

Additionally, the Special Rapporteur has noted two issue areas with respect to artificial intelligence and genetic information, which the Human Rights Committee should consider adapting and incorporating into the general comment for Article 17. First, the Special Rapporteur notes that "all algorithms and artificial intelligence should facilitate monitoring for adverse effects, including

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[108] *General Comment No. 16 on Article 17*, *supra* note 72, at ¶ 10.
[109] *Id.*
[110] *Everything You Need to Know About the Right to Be Forgotten*, EUROPEAN UNION, *accessed* Nov. 17, 2021, *available at* https://gdpr.eu/right-to-be-forgotten/.
[111] *See, e.g.*, GENERAL DATA PROTECTION REGULATION, EUROPEAN UNION, Regulation No. 2017/679, Apr. 27, 2016, at Art. 17, *available at* https://op.europa.eu/en/publication-detail/-/publication/3e485e15-11bd-11e6-ba9a-01aa75ed71a1 https://op.europa.eu/en/publication-detail/-/publication/3e485e15-11bd-11e6-ba9a-01aa75ed71a1 [hereinafter GDPR].
[112] REPORT OF THE SPECIAL RAPPORTEUR ON THE RIGHT TO PRIVACY, U.N. HUMAN RIGHTS COUNCIL, U.N. Doc. A/74/277, Aug. 5, 2019, at ¶ 1, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/N19/244/85/PDF/N1924485.pdf?OpenElement [hereinafter A/74/277].
[113] *Task Force on Privacy and Protection of Health-Related Data,* U.N. SPECIAL RAPPORTEUR ON THE RIGHT TO PRIVACY, *accessed* Nov. 17, 2021, *available at* https://www.ohchr.org/Documents/Issues/Privacy/SR_Privacy/DraftRecommendationProtectionUseHealthRelatedData.pdf.

characteristics protected under applicable laws and United Nations conventions. This provision cannot be used to request, require or record additional demographic data."[114] Protection from algorithmic bias is already a fundamental privacy protection, but algorithmic bias is not described in Article 17, nor is preventing collection of extraneous demographic data. While individuals have the right under Article 17 to inquire about the purpose of data collection,[115] there is no requirement for data minimization, or developing neurotechnology to avoid the "over-collection" of personal data. The UN High Commissioner for Human Rights has advocated that law enforcement "take stock of existing capacities" before using a surveillance medium that threatens "blanket, indiscriminate retention of communications data."[116]

Text limiting the State's collection of personal data to "narrowly relevant" data also can help protect mental privacy. The Office of the UN High Commissioner for Human Rights has partially addressed this concern, noting the importance of encryption to limit sharing of personal data through electronic communications when States monitor peaceful assemblies, but encryption alone does not make data collection automatically compliant with the ICCPR.[117]

Second, the Special Rapporteur notes that genetic data may only be processed subject to "appropriate safeguards where it is either prescribed by law or on the basis of the consent of the data subject."[118] After the purpose for processing genetic data has been achieved, the data must be destroyed in the absence of the consent of the data subject.[119] An analogous provision could be incorporated into the general comment of Article 17, since many consumer neurotechnology companies irrevocably retain brain data and can sell or transfer it to any third party at any time after a user clicks to accept long user agreements that very few users actually read in full.

**Article 18** protects the right to freedom of thought, conscience, and religion,[120] and its language protects against coercive infringements upon agency and identity. This right is also protected under Article 18 of the UDHR.[121] It includes matters of personal conviction and commitment to religion or belief.[122] However, the general comment to Article 18 may not provide enough clarity as to the conceivable ways in which brain altering BCIs infringe upon neurorights that are simultaneously lawful restrictions on freedom of thought under the ICCPR.

For instance, the freedom from coercion to have or adopt a religion or belief and the liberty of parents and guardians to ensure religious and moral education cannot be restricted.[123] If the delivery of religious or moral education is someday performed through a BCI which writes to the

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[114] A/74/277, *supra* note 112, at ¶ 34.3.
[115] *General Comment No. 16 on Article 17*, *supra* note 72, at ¶ 10.
[116] A/HRC/48/31, *supra* note 59, at ¶ 39.
[117] REPORT OF THE HIGH COMMISSIONER ON HUMAN RIGHTS, IMPACT OF NEW TECHNOLOGIES ON THE PROMOTION AND PROTECTION OF HUMAN RIGHTS IN THE CONTEXT OF ASSEMBLIES, INCLUDING PEACEFUL PROTESTS, U.N. HIGH COMM'R FOR HUMAN RIGHTS, U.N. Doc. A/HRC/44/24, June 24, 2020, at ¶ 24, *available at* https://undocs.org/en/A/HRC/44/24.
[118] A/74/277, *supra* note 112, at ¶ 7.1.
[119] *Id.*, at ¶ 7.2.
[120] ICCPR, *supra* note 68, at Art. 18.
[121] Universal Declaration of Human Rights, G.A. Res. 217A (III), U.N. Doc. A/810, *adopted* 1948, at Art. 9 [hereinafter UDHR].
[122] *General Comment No. 22 on Article 18*, *supra* note 19, at ¶ 1.
[123] *Id.*, at ¶ 8.

brain, it would be difficult to document its coercive impact on an individual.[124] The general comment's focus on overtly coercive methods compelling others to adopt beliefs, such as penal sanctions or restrictions on access to education, may be outdated in the age of neuromarketing, neurotechnology, and AI,[125] and the Human Rights Committee should consider updating it. Subtler methods of coercion, including those which are invisible, such as neurotechnology, may violate freedom of belief, and may result in discrimination.

Article 18(3) permits restrictions on the freedom to manifest religion or belief only if its limitations are "prescribed by law and are necessary to protect public safety, order, health or morals, or the fundamental rights and freedoms of others."[126] As discussed for Article 17, surveillance using neurotechnology stands to infringe upon the right to freedom of thought, conscience, or religion by exposing individuals to discrimination based upon their brain activity.

The Special Rapporteur on the Right to Freedom of Religion or Belief has noted not only the dangers of neurotechnology but also has cautioned against "knee-jerk" regulation in countries which stymies legitimate persuasion or medical innovation.[127] In fact, Chile's model of protecting neurorights has been considered as possibly limiting innovation since it prohibits the sale of brain data.[128] Nonetheless, the Special Rapporteur notes that "Experts broadly agree that contemporary legal frameworks are unprepared for emerging predictive and neurotechnologies and their implications for freedom of thought, among other rights."[129] Based upon his expert consultations, he explains that neurotechnology's predictive accuracy is far lower in the real-world than has been previously described, and it is allegedly unable to passively "decode" thoughts that researchers have not predefined.[130]

Still, neurotechnology's success in the laboratory indicates its future potential.[131] While the accuracy of neurotechnology is hotly contested – such as to determine fitness to stand trial, or the use of neuroimaging to determine whether an individual has lied or to predict the likelihood of recidivism[132] – countries are experimenting with its applications. The Special Rapporteur has noted the contexts of forced treatment and coercion of LGBTQI+ individuals as potential areas for abuse.[133]

Therefore, one of the largest protection gaps in Article 18 is protection for human identity. While both the general comment and the Special Rapporteur on the Right to Freedom of Religion or Belief address the scope of "thought" and "belief," neither defines "conscience" at all. The Human Rights Committee should consider providing a definition of conscience to protect mental identity in the wake of neurotechnology.

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[124] *Id.*, at ¶ 5.
[125] *Id.*
[126] ICCPR, *supra* note 68, at Art. 18(3).
[127] A/76/380, *supra* note 40, at ¶ 79.
[128] *Id.*, at ¶ 84.
[129] *Id.,* at ¶ 79.
[130] *Id.*, at ¶ 76.
[131] *Id.*
[132] *Id.*, at ¶ 77; Leda Tortora, Gerben Meynen & Johannes Bijilsma, et al., *Neuroprediction and A.I. in Forensic Psychiatry and Criminal Justice: A Neurolaw Perspective*, 11 FRONTIERS IN PSYCHOL. 220 (2020).
[133] A/76/380, *supra* note 40, at ¶¶ 80-83.

**Article 19** protects the freedom of expression and opinion, which is also protected by the UDHR.[134] It includes the freedom to hold opinions without interference,[135] and to seek, receive, and impart information and ideas through any media and regardless of frontiers.[136] Article 19 protects against discrimination on the basis of opinion, including against algorithmic bias on the basis of "actual, perceived, or supposed" opinions,[137] and protects mental privacy and agency through its stipulation that "any form of effort to coerce the holding or not holding of any opinion is prohibited."[138]

Although Article 19(1) protects against "any" form of coercion to hold or not hold an opinion, the examples explained in the general comment's text focus upon direct efforts to coerce, rather than on instances where coercion is an indirect effect. Theoretically, neurotechnology intended to coerce others to hold an opinion is contemplated by Article 19(1). However, its general comment does not currently account for infringements on neurorights whose unintended consequence is coercion. For example, neurotechnology that aims to change behavior and elicit specific responses from consumers, similarly to neuromarketing,[139] may infringe upon neurorights and target specific groups of people to develop certain preferences or opinions. Article 19(1) already protects individuals from human rights abuse by private actors,[140] but language highlighting how brain data transfers may be coercive could enable States to better protect the freedom of and to form an opinion.

The Special Rapporteur on Freedom of Opinion or Expression elaborates that "an essential element of the right to hold an opinion is the 'right to form an opinion and to develop this by way of reasoning.'"[141] Consequently, "forced neurological interventions, indoctrination programs (such as 're-education camps') or threats of violence design designed to compel individuals to form particular opinions or change their opinion violate Article 19 (1)."[142] Even though the Special Rapporteur discusses "neurological interventions," he does not discuss neurotechnology. To the extent this report addresses coercive technology, it discusses only how AI algorithms curate content and infringe upon freedom to form an opinion.[143] But invasive BCIs, which involve direct brain stimulation that might in the future interfere with, block, or change previously held opinions, are not discussed.

The scope of 19(2) includes "the expression and receipt of communications of every form of idea and opinion capable of transmission to others,"[144] and includes all forms of expression and means of their dissemination (including sign language and non-verbal expression).[145] Protecting all

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[134] ICCPR, *supra* note 68, at Art. 19; UDHR, *supra* note 121, at Art. 19.
[135] ICCPR, *supra* note 68, at Art. 19(1).
[136] *Id.*, at Art. 19(2).
[137] *General Comment No. 34 on Article 19*, U.N. HUMAN RIGHTS COMM., U.N. Doc. CCPR/C/GC/34, Sept. 21, 2011, at ¶ 9, *available at* https://www2.ohchr.org/english/bodies/hrc/docs/gc34.pdf.
[138] *Id.*, at ¶ 10.
[139] Natalia Abuín Vences et al., *Neuromarketing as an Emotional Connection Tool Between Organizations and Audiences in Social Networks. A Theoretical Review*, 11 FRONTIERS PSYCHOL. 1787 (2020), *available at* https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01787/full.
[140] *General Comment No. 34 on Article 19*, *supra* note 137, at ¶ 7.
[141] A/73/348, *supra* note 73, at ¶ 23.
[142] *Id.*
[143] *Id.*, at ¶ 24.
[144] *General Comment No. 34 on Article 19*, *supra* note 137, at ¶ 11.
[145] *Id.*, at ¶ 12.

forms of communication and ideas enables individuals to freely express their personal thoughts and beliefs in a form they choose – and the broad inclusion of all means of dissemination protects access to information.[146] The Human Rights Committee should consider further interpreting Article 19(2) to address technologies which are used both to disseminate ideas and for mental augmentation.

Further, to bolster the protection of agency, mental privacy, and identity, the UN High Commissioner for Human Rights called for "robust export control regimes for the cross-border trade of surveillance technologies in order to prevent the sale of such technologies when there is a risk that they could be used for violating human rights, including by targeting human rights defenders or journalists."[147] The Human Rights Committee should consider classifying neurotechnology as a form of surveillance technology in the general comment to Article 19. This move could incentivize States to be clearer about how they use and regulate neurotechnology, and it may provide valuable assistance to the UN human rights bodies in identifying which standards to apply to individual communications.

### *C. Articles which do not protect against misuse and abuse of neurotechnology*

**Article 6** states that "Every human being has the inherent right to life. This right shall be protected by law. No one shall be arbitrarily deprived of his life."[148] Where neurotechnology is combined with AI to deploy weapons, machine learning algorithms may permit the technology to make autonomous targeting decisions based upon a soldier's brain activity. For example, DARPA in the U.S. is creating a non-invasive BCI for soldiers which will communicate with ("write to") multiple areas of the brain simultaneously, and which will allow soldiers to supervise and control weapons systems in remote locations.[149] Not only does this technology raise international humanitarian law concerns, it highlights the risks of algorithmic bias leading to arbitrary execution, since those biases would derive from human brain activity. In this way, neurotechnology elevates debates concerning "human-on-the-loop" weapons and raises separate issues of agency for soldiers.

## II. THE CONVENTION AGAINST TORTURE AND OTHER CRUEL, INHUMAN OR DEGRADING TREATMENT OR PUNISHMENT

The Convention Against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment ("CAT") embodies a *jus cogens*, or peremptory, norm of international law: the prohibition on torture and cruel, inhuman or degrading treatment.[150] No exceptional circumstances can ever make torture legal, including war.[151] And the prohibition against torture also is codified in several declaratory international instruments, such as the UDHR.[152] Article 22 of the CAT enables the Committee Against Torture to receive and consider individual communications, provided States

[146] *Id.*, at ¶ 18.
[147] A/HRC/48/31, *supra* note 59, at ¶ 46.
[148] ICCPR, *supra* note 68, at Art. 6.
[149] Al Emondi, *Next-Generation Nonsurgical Neurotechnology*, DARPA, *accessed* Nov. 12, 2021, *available at* https://www.darpa.mil/program/next-generation-nonsurgical-neurotechnology; RAND, *supra* note 47.
[150] Convention Against Torture, 1465 U.N.T.S. 85, *adopted* Dec. 10, 1984, at Art. 1 [hereinafter CAT]; CAT/C/GC/2, *supra* note 56, at ¶¶ 2-5.
[151] CAT, *supra* note 150, at Art. 2(2); ICCPR, *supra* note 68, at Art. 7.
[152] UDHR, *supra* note 121, at Art. 5; Principles of Medical Ethics, *supra* note 55, at Principle 1.

parties make the necessary declarations.[153] **Currently, none of the CAT's articles, general comments, or associated jurisprudence mention neurotechnology.**

By contrast, the Special Rapporteur on Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment has addressed neurotechnology.[154] Special Rapporteur Nils Melzer comments, "Given rapid advances in medical, pharmaceutical and neurotechnological science. . .it is difficult to predict to what extent future techniques and environments of torture, as well as the 'human enhancement' of potential victims and perpetrators in terms of their mental and emotional resilience."[155] One way in which the Special Rapporteur recognizes risks of torture is through remote-controlled "neurotechnological devices,"[156] such as those being developed for soldiers.[157] Neurotechnology may thereby allow perpetrators to circumvent or manipulate the subjective experience of pain, while still achieving the dehumanizing effects of torture.[158]

The Special Rapporteur also has noted,

> [I]t would appear irreconcilable with the object and purpose of the universal, absolute and non-derogable prohibition of torture, for example, to exclude the profound disruption of a person's mental identity, capacity or autonomy from the definition of torture only because the victim's subjective experience or recollection of 'mental suffering' has been pharmaceutically, hypnotically or otherwise manipulated or suppressed.[159]

Identity and agency are at the forefront of improving the CAT's neurorights protection. Detained individuals' rights to equal access to mental augmentation are discussed in Chapter III on the right to health. The Special Rapporteur's broad language, "pharmaceutically, hypnotically or otherwise manipulated" indicates that *any* technology which infringes an individual's subjective experience of pain may violate the CAT. Broad language can help further interpret the CAT to account for invisible ways that neurotechnology infringes upon human rights.

### *A. Articles which protect against most misuse and abuse of neurotechnology*

**Article 1(1)** of the CAT protects against most misuse and abuse of neurotechnology when it is used to perpetrate torture or cruel, inhuman, or degrading treatment. This Article defines torture as:

> any act by which severe pain or suffering, whether physical or mental, is intentionally inflicted on a person for such purposes as obtaining from him or a third person information or a confession, punishing him for an act he or a third person has committed or is suspected of having committed, or

[153] CAT, *supra* note 150, at Art. 22.
[154] Nils Melzer, REPORT OF THE SPECIAL RAPPORTEUR ON TORTURE AND CRUEL, INHUMAN OR DEGRADING TREATMENT OR PUNISHMENT, U.N. Doc. A/HRC/43/49, Feb. 14, 2020, at ¶ 32 [hereinafter A/HRC/43/49].
[155] *Id.*
[156] *Id.* at ¶ 73.
[157] *Id.* (citing Emondi, *supra* note 149).
[158] *Id.*
[159] *Id.*

> intimidating or coercing him or a third person, or for any reason based on discrimination of any kind, when such pain or suffering is inflicted by or at the instigation of or with the consent or acquiescence of a public official or other person acting in an official capacity. It does not include pain or suffering arising only from, inherent in or incidental to lawful sanctions.[160]

Whether an act qualifies as torture depends upon the purpose for which it was committed, and whether it occurred at the direction of a State, or with its consent or acquiescence. Therefore, Article 1(1) protects individuals from torture by both State agents and private actors, thereby also protecting against misuses and abuses of neurotechnology that qualify as torture or cruel, inhuman, or degrading treatment.

Where Article1(1) may fall short of full protection in the age of neurotechnology is in the distinction between using neurotechnology to cause torture and where the use of a certain neurotechnology device is *de facto* torture in all circumstances. Unpacking this distinction will require definitional clarity under Article 1(1), particularly for the terms "mental pain or suffering," and "severe." For example, if law enforcement non-consensually implanted an invasive BCI, it could be considered as the intentional infliction of pain for the purpose of obtaining information, eliciting a confession, or punishment – non-consensual surgery would clearly run afoul of both the CAT and other international human rights instruments.[161]

However, Article 1(1)'s thresholds for severe mental pain and suffering are fuzzier for non-invasive BCIs, which may not leave any injury or cause any "pain" in the ordinary sense. The use of a non-invasive BCI which triggers a traumatic memory, or which causes nerve damage, more obviously causes physical pain and mental suffering and infringes upon agency and identity, since the individual is compelled to remember. But where a BCI is simply passively translating thoughts into text with no pain or suffering or where the wearer does not know about the BCI's existence (such as through non-consensual application of a wearable BCI during sleep), it is less likely this would fall within the definition of torture. The CAT does not explicitly require proof of injury,[162] but a lack of evidence may disadvantage a complainant. Consequently, the Committee Against Torture should consider further interpreting Article 1(1)'s definitional limits beyond conventional technology. A general comment on Article 1 raising neurotechnology's impact on a person's subjective experience of pain also may help future complainants document injuries from non-invasive BCIs.[163]

Because mental privacy should be an absolute right, it could be very helpful for a general comment on Article 1 to state explicitly that the monitoring and interpretation of individuals' brain activity, including their thoughts, either against their wishes or without their knowledge, constitutes cruel, inhuman, or degrading treatment or punishment. Fast-approaching mind-reading technology intrudes into an individual's brain, which creates his or her identity and personality, and everything

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[160] CAT, *supra* note 150, at Art. 1(1).
[161] *See, e.g.*, ICCPR, *supra* note 68, at Arts. 7 and 17; UDHR, *supra* note 121, at Arts. 9 and 17; Principles of Medical Ethics, *supra* note 55, at Principle 1; REPORT OF THE SPECIAL RAPPORTEUR ON TORTURE AND OTHER CRUEL, INHUMAN OR DEGRADING TREATMENT OR PUNISHMENT, JUAN E. MÉNDEZ, U.N. HUMAN RIGHTS COUNCIL, U.N. Doc. A/HRC/22/53, Feb. 1, 2013, at ¶¶ 29, 77.
[162] *See* Annex I, *Model Complaint Form*, U.N. COMM. AGAINST TORTURE, OFFICE FOR THE HIGH COMMISSIONER FOR HUMAN RIGHTS, *available at* https://www.ohchr.org/Documents/Publications/FactSheet4rev.1en.pdf.
[163] *See* A/HRC/43/49, *supra* note 154, at ¶ 32.

that makes them human. As discussed in the Methodology section, *International Human Rights Protection Gaps in the Age of Neurotechnology* recommends that the monitoring and interpretation of individuals' brain activity without their consent (or the consent of their legal guardian) be prohibited under international human rights law.

Moreover, the Committee Against Torture should clarify when the use of BCIs is considered incident to lawful sanctions. As discussed under Article 14(3) in Chapter I, questions concerning whether neuroimaging or EEGs is equivalent to more familiar technologies, such as polygraph tests, will largely determine whether a non-invasive BCI is inherent in lawful sanctions.

### *B. Articles which could be further interpreted to protect against misuse and abuse of neurotechnology*

**Article 2(2)** requires States to implement effective legal safeguards to prevent torture in any territory under their jurisdiction, including criminalization.[164] The Committee Against Torture has recognized that any discrepancies between the CAT's definition and domestic definitions of torture "create actual or potential loopholes for impunity."[165] Although ill-treatment is likewise prohibited under **Article 16**,[166] in comparison to torture, ill-treatment may differ in the severity of pain and suffering, and does not require any proof of impermissible purposes.[167] This definitional distinction between torture and ill-treatment[168] creates daylight for the abuse of non-invasive BCIs, which can serve multiple permissible purposes (such as for medical treatment) and whose use in/as torture may evade detection. To maximize protection of neurorights, the Committee Against Torture should consider classifying when the use of neurotechnology is *de facto* torture or ill-treatment and incorporate into its general comment on Article 2's broad safeguards.

The Special Rapporteur on Torture has warned that even where neurotechnology can lessen the subjective experience of pain, it is still possible to commit torture.[169] This danger is inherent to non-invasive BCIs, as well as to Transcranial Direct Current Stimulation ("TDCS"), a technology for mental augmentation that is widely available to ordinary consumers, and which stimulates the brain using electrical currents.[170] Even though the long-term health effects of TDCS are unknown and may even adversely impact brain health, the devices themselves can lessen the user's experience of pain in the short term.[171] TDCS or non-invasive BCIs may be misused or abused to force criminal suspects to withstand longer interrogations, or to keep them awake for days – both of

[164] CAT, *supra* note 150, at Arts. 2(2), 4; CAT/C/GC/2, *supra* note 56, at ¶ 8.
[165] CAT/C/GC/2, *supra* note 56, at ¶ 9.
[166] CAT, *supra* note 150, at Art. 16.
[167] *Id.*, at ¶ 10.
[168] *Id.*, at Art. 1(1).
[169] A/HRC/43/49, *supra* note 154, at ¶ 32.
[170] Melissa Hogenboom, *Warning Over Electrical Brain Stimulation*, BBC, Aug. 24, 2014, *available at* https://www.bbc.com/news/health-27343047.
[171] *Does Shocking Your Brain Really Increase Performance?*, WIRED, May 31, 2016, *available at* https://www.wired.co.uk/article/darpa-tdcs.

which are clear violations of the CAT.[172] The abuse of neurotechnology and other forms of mental augmentation in these ways infringes upon mental agency and identity.[173]

**Article 15** requires that "any statement which is established to have been made as a result of torture shall not be invoked as evidence in any proceedings, except against a person accused of torture as evidence that the statement was made."[174] The text of Article 15 has been simultaneously described as fundamental to preventing torture and as the CAT's "weakest provision."[175] For instance, it does not define "any proceedings," and there is currently no general comment on Article 15 providing definitional clarity.[176] States tend to interpret "any proceedings" narrowly, to include only criminal judicial proceedings against the person who has made the statement,[177] but to improve protection for neurorights, "any proceedings" should be interpreted to include administrative and civil judicial proceedings, military commissions, or immigration boards.[178]

If statements obtained through torture are admissible in any forum, there is an incentive to perpetrate torture,[179] including through the abuse of neurotechnology. Such abuse could lead to an incriminating EEG or biased AI interpretation of brain data which predetermines a criminal suspect's guilt. If obtained without freely given consent, this brain data should be excluded from proceedings. While Article 15 also does not define an inadmissible "statement," the Special Rapporteur extends "statement" not only to confessions, but also to real evidence obtained through torture, and to evidence obtained legally but which originated in an act of torture.[180] EEGs, neuroimaging, and AI interpretations of brain data may all be considered statements under the Special Rapporteur's interpretation, which the Committee Against Torture should consider addressing in a new General Comment on Article 15.

Although Article 2's safeguards to prevent torture also apply to Article 15,[181] defining in a general comment when brain data could be admissible in proceedings would help protect mental privacy, agency, and freedom from algorithmic discrimination (where the brain data is given to an AI algorithm for analysis and that analysis is also admissible).

### *C. Articles which do not protect against misuse and abuse of neurotechnology*

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[172] *See Bairamov v. Kazakhstan*, Communication No. 497/2012, U.N. Doc. CAT/C/52/D/497/2012, U.N. COMM. AGAINST TORTURE, *adopted* May 14, 2014, at ¶¶ 2.5, 8.2 (finding that sleep deprivation may be an act considered as torture under article 1 of the CAT).

[173] Although humane interrogation, broadly, is not the subject of this gap analysis, declaratory instruments may assist the Committee Against Torture in thinking through how to protect against the misuse and abuse of neurotechnology.

[174] CAT, *supra* note 150, at Art. 15.

[175] REPORT OF THE SPECIAL RAPPORTEUR ON TORTURE OR OTHER CRUEL, INHUMAN OR DEGRADING TREATMENT OR PUNISHMENT, U.N. HUMAN RIGHTS COUNCIL, U.N. Doc. A/HRC/25/60, Apr. 10, 2014, at ¶ 17 [hereinafter A/HRC/25/60].

[176] *Id.*

[177] *Id.*

[178] *Id.*, at ¶ 30; *see G.K. v. Switzerland*, Communication No. 219/2002, U.N. Doc. CAT/C/30/D/219/2002, U.N. COMM. AGAINST TORTURE, *adopted* May 7, 2003, at ¶ 6.3.

[179] A/HRC/25/60, *supra* note 175, at ¶ 17.

[180] *Id.*, at ¶ 29.

[181] CAT/C/GC/2, *supra* note 56, at ¶ 6.

The Committee Against Torture "emphasizes that the obligation to take effective preventive measures transcends the items enumerated specifically in the Convention," and that the content of General Comment No. 2 (on the obligation to prevent torture and safeguards) applies to **Articles 3-15** of the CAT.[182] For example, **Article 10(1)** requires that public officials be trained and educated in the prohibition of torture.[183] If Article 1(1)'s definition of torture encompasses the potential abuse of neurotechnology, then in fulfillment of its obligation to prevent torture under Article 2(2), the State must accordingly educate its public officials. As another example, **Article 11** obligates States parties to "keep under systematic review interrogation rules, instructions, methods and practices."[184] Consequently, to comply with its obligations under Article 2(2), States must systematically update their interrogation rules, instructions, methods, and practices to prevent torture through protecting neurorights.

## III. THE INTERNATIONAL COVENANT ON ECONOMIC, SOCIAL AND CULTURAL RIGHTS

The International Covenant on Economic, Social and Cultural Rights ("ICESCR") was adopted in 1966 and entered into force in 1976.[185] The ICESCR has an Optional Protocol enabling the Committee on Economic, Social, and Cultural Rights to receive and consider individual communications.[186] **Currently, none of the ICESCR's articles, general comments, or associated jurisprudence mention neurotechnology.** However, many of its articles and general comments may be further interpreted to protect against the potential misuse and abuse of neurotechnology. Further, relevant Special Rapporteurs' reports provide a foundation for protecting neurorights and for incorporating neurotechnology into the Committee's lexicon.

For instance, the thematic report by the Special Rapporteur in the Field of Cultural Rights published a thematic report in 2021 outlining the normative obligations of States with respect to the development of science and technology.[187] By implication, these obligations extend to neurotechnology, and they explicitly include:

> (a) access to the benefits of science by everyone, without discrimination; (b) opportunities for all to contribute to the scientific enterprise and freedom indispensable for scientific research; (c) participation of individuals and communities in decision-making; and (d) an enabling environment fostering the conservation, development and diffusion of science and technology.[188]

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[182] *Id.*, at ¶ 25.
[183] CAT, *supra* note 150, at Art. 10(1).
[184] *Id.*, at Art. 11.
[185] International Covenant on Economic, Social and Cultural Rights, 993 U.N.T.S. 3, *entered into force* Jan. 3, 1976 [hereinafter ICESCR].
[186] Optional Protocol to the Covenant on Economic, Social and Cultural Rights, G.A. Res A/RES/63/117, *adopted* Dec. 10, 2008.
[187] Karima Bennoune, REPORT OF THE SPECIAL RAPPORTEUR IN THE FIELD OF CULTURAL RIGHTS, U.N. Doc. A/HRC/46/34, Feb. 17, 2021, at ¶ 67, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/G21/035/23/PDF/G2103523.pdf?OpenElement. *See also* Farida Shaheed, REPORT OF THE SPECIAL RAPPORTEUR IN THE FIELD OF CULTURAL RIGHTS, U.N. Doc. A/HRC/20/26, May 14, 2012, at ¶ 25, *available at* https://www.ohchr.org/Documents/HRBodies/HRCouncil/RegularSession/Session20/A-HRC-20-26_en.pdf [hereinafter A/HRC/20/26].
[188] A/HRC/20/26, *supra* note 187, at ¶ 25.

Thus, the strongest area of protection against misuse and abuse of neurotechnology are those concerning equal access to mental augmentation and protection from algorithmic bias. Additional language in the ICESCR's articles and general comments creates a foundation for including neurorights and neurotechnology, and many concepts contained within the treaty readily apply to neurorights. In its current form, however, the ICESCR is ill-equipped to protect against the misuse and abuse of neurotechnology, particularly those which infringe upon identity and mental privacy.

### *A. Articles which protect against most misuse and abuse of neurotechnology*

**Article 12(1)** says that "the States Parties to the present Covenant recognize the right of everyone to the enjoyment of the highest attainable standard of physical and mental health."[189] When and if BCIs become pervasive in mental healthcare or in living the highest attainable quality of life,[190] individuals (including those in prison) may have a right to use them as part of the highest attainable standard of physical and mental health. This right protects equal access to mental augmentation, and broadly contemplates all technological development as it affects standards of health.

This is an area where the distinction between invasive and non-invasive BCIs matters deeply for the protection of human rights. Under the ICESCR, there must be equal access to, for example, invasive BCIs which treat ALS (Lou Gehrig's disease) if they become sufficiently prevalent in medicine and represent the highest attainable standard of health in the community. Conversely, it is unlikely that the neuroright of equal access to mental augmentation will ever protect access to a non-invasive BCI which improves videogame performance.

For instance, Article 12(1) likely does not protect equal access to consumer neurotechnology, unless a device is being pervasively used in and sought after for the purpose of healthcare (rather than for recreational or educational use). In fact, **Article 12(2)(b)** requires States to create conditions to ensure fair access to neurotechnology if its use *were recognized as a medical treatment of mental illness.* Even then, when Article 12 is read in conjunction with **Article 2(1)**, which says "Each State Party. . .undertakes to take steps. . .to the maximum of its available resources, with a view to achieving progressively the full realization of the rights recognized in the [ICESCR],"[191] such fair access need only be progressive, not immediate, and only to the maximum of available resources.

### *B. Articles which could be further interpreted to protect against misuse and abuse of neurotechnology*

**Article 15(1)** requires States parties to recognize the right of everyone to "take part in cultural life,"[192] and "to enjoy the benefits of scientific progress and its applications."[193] As stated in the thematic report of the Special Rapporteur in the Field of Cultural Rights, the "normative content of the right to benefit from scientific progress and its applications includes. . .access to the

[189] ICESCR, *supra* note 185, at Art. 12(1).
[190] *General Comment No. 14 on Article 12*, U.N. COMM. ON ECONOMIC, SOCIAL AND CULTURAL RIGHTS, U.N. Doc. E/C.12/2000/4, 2000, at ¶¶ 2-4, *available at* https://digitallibrary.un.org/record/425041?ln=en.
[191] ICESCR, *supra* note 185, at Arts. 2(1), 12(2)(b).
[192] *Id.*, at Art. 15(1)(a).
[193] *Id.*, at Art. 15(1)(b).

benefits of science by everyone, without discrimination."[194] Therefore, Article 15(1) protects equal access to mental augmentation and against algorithmic bias. However, the precise interpretation of Article 15 must be further interpreted to protect these neurorights and mental privacy.

Placing more examples in the general comment could strengthen Article 15's neurorights protection. The general comment to Article 15 explains a four-step plan for the "national implementation" of programs ensuring fair access to science and technology, which both (1) echoes the normative framework established by the Special Rapporteur (above) and which (2) further includes an obligation for States to identify appropriate benchmarks and indicators to monitor equality in benefitting from scientific progress.[195] For Article 15 to effectively address neurorights and other misuse and abuse of neurotechnology, the Committee on Economic, Social and Cultural Rights should consider advocating that device development be regulated in accordance with international standards, such as the Venice Statement on the Right to Enjoy the Benefits of Scientific Progress and its Applications, and the UNESCO Bioethics Declaration, and indicator development should occur early in the regulation process. The Committee may consider providing examples of successful indicators in its general comment, particularly those which may apply to neuroscience and neurotechnology.

Article 15 and its accompanying general comment demonstrate awareness of the benefits and risks posed to human rights by rapidly advancing technology. The general comment recognizes that technological innovations "might change not only society and human behaviour, but even human beings themselves."[196] It identifies that artificial intelligence threatens to "reinforce discrimination" and the ability of many corporate entities to "access, store and exploit massive data."[197] These concerns likewise apply to neurotechnology, but the Committee should consider explicitly referencing neurotechnology in its general comments since it revolutionizes the type of data that can be exploited. For instance, the Kernel Flow helmet stores users' EEG data and uploads it to the Cloud, where it is irrevocably owned by the company.[198] Incorporating examples of the types of data contemplated within the general comment may encourage greater mental privacy protection under the ICESCR.

### *C. Articles which do not protect against misuse and abuse of neurotechnology*

**Article 6(1)** of the ICESCR protects the right to work and states, "The States Parties to the present Covenant recognize the right to work, which includes the right of everyone to the opportunity to gain his living by work which he freely chooses or accepts and will take appropriate steps to safeguard this right."[199] By including the language "freely choose or accept," Article 6(1)

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[194] A/HRC/20/26, *supra* note 187, at ¶ 25.
[195] *General Comment No. 25 on Article 15*, U.N. COMM. ON ECONOMIC, SOCIAL AND CULTURAL RIGHTS, U.N. Doc E/C.12/GC/25, Apr. 30, 2020, at ¶¶ 85-89, *available at* https://docstore.ohchr.org/SelfServices/FilesHandler.ashx?enc=4slQ6QSmlBEDzFEovLCuW1a0Szab0oXTdImnsJZZVQdxONLLLJiul8wRmVtR5Kxx73i0Uz0k13FeZiqChAWHKFuBqp%2B4RaxfUzqSAfyZYAR%2Fq7sqC7AHRa48PPRRALHB.
[196] *Id.*, at ¶ 72.
[197] *Id*., at ¶ 76.
[198] *Privacy Policy*, KERNEL, *accessed* Nov. 16, 2021, *available at* https://www.kernel.com/device-services-privacy-policy-2021-1.
[199] ICESCR, *supra* note 185, at Art. 6(1).

implicitly requires an individual to have a strong sense of agency and identity for its protections to be effective, and notes that individuals may not be "unfairly deprived" of the right to work.[200] However, the Committee should consider explicitly mentioning this requirement in the general comment to Article 6 to protect individuals from forced labor compelled through neurotechnology.[201]

The general comment on Article 6 will require new language after neurosurveillance enters the workplace.[202] For example, "sociometric badges," which track workers' productivity and stress levels, are being exchanged for neurological monitoring caps which show brain activity as assembly line workers adjust to new inputs and workflows.[203] Chinese companies have begun using sensors inside workers' helmets to monitor their productivity levels.[204] At a factory in Hangzhou, production line workers are allegedly being outfitted with hats and helmets which read brain signals to decode workers' emotions – and then this data is fed to artificial intelligence algorithms to detect changes in emotion which affect productivity levels.

Although the *MIT Technology Review* believes these helmets do not yet provide reliable data, "China is indeed leading the way in workplace surveillance in a way that stands to benefit no one."[205] Similar practices are likely to become prevalent as multinational corporations seek to regulate their workforces. U.S.-based Amazon, for instance, has been accused of using invasive surveillance technology to track worker productivity and which prevents workers from joining unions,[206] which also violates Article 6.[207]

The lack of neurorights protection in Article 6 will likely intersect with **Article 7(1)**, which protects the right to enjoy just and favorable work conditions, in particular:

(a) Remuneration which provides all workers, as a minimum, with:
    i. Fair wages and equal remuneration for work of equal value without distinction of any kind, in particular women being guaranteed conditions of work not inferior to those enjoyed by men, with equal pay for equal work; [and]
(b) Safe and healthy working conditions.[208]

Neurotechnology may be used to determine fair rates of renumeration based upon worker productivity. However, as employers examine employee productivity, mental privacy is unprotected, since it is unclear what types of brain data must be analyzed. If neurotechnology is used to fulfill the obligations of Article 7, it undermines the protections of Article 6.

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[200] *General Comment No. 18 on Article 6*, U.N. COMM. ON ECONOMIC, SOCIAL & CULTURAL RIGHTS, U.N. Doc. E/C.12/GC/18, Feb. 6, 2006, at ¶ 4, *available at* https://www.refworld.org/docid/4415453b4.html.
[201] *Id.*, at ¶ 6.
[202] Valerio de Stefano, *Neuro-Surveillance and the Right to Be Human at Work*, ONLABOR, Feb. 15, 2020, *available at* https://www.onlabor.org/neuro-surveillance-and-the-right-to-be-humans-at-work/.
[203] *Id.*
[204] VICE NEWS, *supra* note 44.
[205] Erin Winick, *supra* note 44.
[206] Graig Graziosi, *Amazon Uses Worker Surveillance to Boost Performance and Stop Staff from Joining Unions, Study Says*, THE INDEPENDENT, Sept. 1, 2020, *available at* https://www.independent.co.uk/news/world/americas/amazon-surveillance-unions-report-a9697861.html.
[207] ICESCR, *supra* note 185, at Art. 16(c); *General Comment No. 18 on Article 6*, *supra* note 200, at ¶ 2.
[208] ICESCR, *supra* note 185, at Art. 7(1).

Further, without a system to regulate the role of neurotechnology in determining fair renumeration, there is no protection against algorithmic bias. Algorithms interpreting brain activity could learn and develop racial or sexist biases – and States or companies might only target select workers for productivity tracking based upon discriminatory grounds. Individuals whose methods of working do not generate the brain activity sought by an algorithm could be unfairly targeted, such as persons with disabilities. This outcome would also infringe upon mental identity and agency since algorithms may reward working and thinking in a particular way and coerce individuals to fundamentally change themselves.

**Article 13**, in its entirety, recognizes the human right to education.[209] Its accompanying general comment does not currently anticipate neurotechnology's fundamental impact on society. As brain-writing BCIs develop, they may be used in education settings to receive and impart information, or as a means for depositing new information into the mind altogether (such as a thought-to-translation device or one which enables human-to-human communication using a BCI). Currently, the general comment notes that the "the form and substance of education, including curricula and teaching methods, have to be acceptable (*e.g.*, relevant, culturally appropriate and of good quality) to students and, in appropriate cases, parents," and "this is subject to the educational objectives required by Article 13 (1) and such minimum educational standards as may be approved by the State."[210]

Article 13 and its general comment fail to capture scenarios in which neurotechnology infringes upon mental privacy and free will, but it is considered relevant, educational, and falls within the minimum educational standards approved by the State. For example, the U.S.-based company BrainCo developed the Focus1 headband to monitor students' attention levels in the classroom.[211] BrainCo donated 50 such headbands in 2018 to Jinhua Xiaoshun Primary School in eastern China. Students wore the headband, and it displayed their attention levels to the entire class, simulated as rockets on a screen, provoking massive domestic backlash.[212] Parents of students have complained that their children are being treated as "guinea pigs" and the program was reportedly disbanded. Nevertheless, under the current content of the right to education, Focus1's unfettered use in primary schools would be permissible so long as it was acceptable to students and parents and relevant to education. Thus, the Committee on Economic, Social and Cultural Rights should consider updating the general comment on Article 13 to require protecting mental privacy as part of the State's minimum standards for education.

Finally, the Committee on Economic, Social and Cultural Rights should consider updating the general comment to Article 13 to reflect the potential misuse of neurotechnology as a disciplinary tool in schools. The general comment protects human dignity in education, and views corporal punishment and "public humiliation" as inconsistent with this human right – instead favoring "non-violent approaches to school discipline."[213] The general comment's focus on the

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[209] *Id.*, at Art. 13.
[210] *General Comment No. 13 on Article 13*, U.N. COMM. ON ECONOMIC, SOCIAL & CULTURAL RIGHTS, U.N. Doc. E/C.12/1999/10, Dec. 8, 1999, at ¶ 6(b), *available at* https://www.ohchr.org/EN/Issues/Education/Training/Compilation/Pages/d)GeneralCommentNo13Therighttoeducation(article13)(1999).aspx.
[211] Jane Li, *A "Brain-Reading" Headband for Students is Too Much Even for Chinese Parents*, QUARTZ, Nov. 5, 2019, *available at* https://qz.com/1742279/a-mind-reading-headband-is-facing-backlash-in-china/ [hereinafter Li].
[212] *Id.*
[213] *General Comment No. 13 on Article 13*, *supra* note 210, at ¶ 41.

violent/non-violent distinction in school discipline does not contemplate the non-violent but still humiliating and coercive effects of BCI use in schools, such as if students were disciplined because BCI-monitored concentration levels projected onto a screen in front of a class showed they were not concentrating.

## IV. THE CONVENTION ON THE RIGHTS OF PERSONS WITH DISABILITIES

The Convention on the Rights of Persons with Disabilities ("CRPD") entered into force in 2008.[214] It has an Optional Protocol enabling the Committee on the Rights of Persons with Disabilities to receive and consider individual communications.[215] **Currently, none of the CRPD's articles, general comments, or associated jurisprudence mention neurotechnology.** For instance, technology is mentioned in the CRPD's General Comment No. 6 on the Right to Equality and Non-Discrimination, but it is mentioned solely within the context of equal access to assistive technologies – without specifying the types of technologies considered.[216] Many of the CRPD's articles and general comments may be further interpreted, respectively, to protect against the potential misuse and abuse of neurotechnology. The strongest areas for protection under the CRPD include equal access to mental augmentation and protection from algorithmic bias.[217] Its weakest areas include infringements upon mental privacy, including data protection and storage, as well as data collection during medical treatment.

These protection gaps are reflected in UN reports, including those of the Special Rapporteur on the Rights of Persons with Disabilities. The Special Rapporteur has not yet issued a report addressing neurotechnology. As of November 5, 2021, the Special Rapporteur is planning to report on the impact of AI on persons with disabilities[218] – however, that report does not plan to address the effects on human rights of AI when it combines with other technologies, such as neurotechnology. The impact of AI on persons with disabilities is more likely to affect individuals with visible, rather than intellectual, disabilities. Nonetheless, the Special Rapporteur has previously discussed that biotechnologies and other emerging technologies "raise significant ethical issues concerning the nature, safety and appropriateness of such technologies, as well as their impact on the lives of persons with disabilities."[219]

Further, the Special Rapporteur noted, "These cutting-edge tools grant humanity unprecedented power to prevent and "repair" disability."[220] It is essential to address not only

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[214] Convention on the Rights of Persons with Disabilities, 2515 U.N.T.S. 3, *entered into force* May 3, 2008 [hereinafter CRPD].
[215] Optional Protocol on the Convention on the Rights of Persons with Disabilities, G.A. Res. 61/106, *adopted* Dec. 13, 2008, at Art. 1.
[216] *General Comment No. 6 on Article 5*, *supra* note 18, at ¶¶ 24-28.
[217] *See Id*., at ¶ 28 (discussing the obligation of States to prevent the perpetuation of isolation, segregation, stereotyping, stigmatization or otherwise discrimination against persons with disabilities).
[218] Ridhi Shetty, *Comments on AI's Impact on People with Disabilities to UN Special Rapporteur*, CENTER FOR DEMOCRACY & TECHNOLOGY, Nov. 5, 2021, *available at* https://cdt.org/insights/comments-on-ais-impact-on-people-with-disabilities-to-un-special-rapporteur/; *Re: Inputs - for SR Disability Report on Artificial Intelligence*, CENTER FOR DEMOCRACY & TECHNOLOGY, Nov. 3, 2021, *available at* https://cdt.org/wp-content/uploads/2021/11/Comments-to-UN-SR-for-Disability-Report-on-Artificial-Intelligence.pdf.
[219] REPORT OF THE SPECIAL RAPPORTEUR ON THE RIGHTS OF PERSONS WITH DISABILITIES, U.N. HUMAN RIGHTS COUNCIL, U.N. Doc. A/HRC/43/41, Dec. 17, 2019, at ¶ 22, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/G19/346/54/PDF/G1934654.pdf?OpenElement.
[220] *Id.*

questions of equal access to neurotechnology for individuals with disabilities, but also neurotechnology's impact on the acceptance of mental illness, diversity, and difference, generally. These questions severely impact mental identity and agency, as well as protection from algorithmic bias. While autonomy is central to bioethics, persons with intellectual disabilities and psychosocial disabilities are often considered "incompetent" to consent to treatment and may be subjected to involuntary medical interventions aimed at "correcting" their impairments.[221] The Special Rapporteur attributes this outcome to ableist views, which will likely increase as neurotechnology enhances human capabilities – and algorithms will intuit these biases.

Additionally, in 2018, the UN issued a report concerning the realization of the Sustainable Development Goals which focused upon persons with disabilities.[222] Among the report's recommendations is building countries' capacity to disaggregate national data by disability.[223] While this data would enable better quality health care services for people with disabilities, it may also lead to disproportionate data collection in the age of neurotechnology which could be used to discriminate against them. For example, AI tools which are used for diagnostic and treatment purposes may have standardized approaches that intuit racial, gender, and class biases, as well as biases against disability.[224] As an algorithm learns these biases, it may eliminate individuals from its data set and later lead to medical interventions that are not based on the actual needs of persons with disabilities.[225] The impact of AI-BCI combined technology may similarly compound discrimination.

The Special Rapporteur has previously noted that States face dual imperatives in fulfilling their obligations under the CRPD. First, States must ensure that persons with disabilities have freedom from non-consensual medical treatment and experimentation.[226] Second, States must expeditiously and effectively mobilize their available resources towards the right to health.[227] The Committee on the Rights of Persons with Disabilities should consider incorporating new language into either a general comment on the CRPD or into the upcoming thematic report explaining States' obligation to ensure that neurotechnology used in the health care of persons with disabilities must refrain from discrimination and cannot be used without an individual's or their guardian's consent.

### *A. Articles which protect against most misuse and abuse of neurotechnology*

**Articles 1, 2, and 3** broadly protect the neuroright of equal access to mental augmentation. The definitions and principles they establish indicate that if BCIs are used primarily to ease communication, alleviate symptoms, or treat medical conditions for people with disabilities, they

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[221] *Id.*, at ¶ 29.
[222] Cynthia Bennett & Os Keyes, *What is the Point of Fairness? Disability, AI, and the Complexity of Justice*, 27 ACM SIGACCESS ACCESSIBILITY & COMPUTING 2-3 (2019) [hereinafter Bennett & Keyes].
[223] REALIZING THE SUSTAINABLE DEVELOPMENT GOALS BY, FOR, AND WITH PERSONS WITH DISABILITIES (2018), U.N. DEP'T OF ECON. AND SOC. AFFAIRS, REP. ON DISABILITY AND DEVELOPMENT, 2018, at 2, *available at* https://social.un.org/publications/UN-Flagship-Report-Disability-Final.pdf.
[224] Bennett & Keyes, *supra* note 222, at 2-3.
[225] Ziad Obermeyer et al., *Dissecting Racial Bias in an Algorithm Used to Manage the Health of Populations*, 366 SCIENCE 447 (2019).
[226] REPORT OF THE SPECIAL RAPPORTEUR ON THE RIGHTS OF PERSONS WITH DISABILITIES, U.N. HUMAN RIGHTS COUNCIL, U.N. Doc. A/73/161, July 16, 2018, at ¶ 18, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/N18/224/75/PDF/N1822475.pdf?OpenElement.
[227] *Id.*

could fall within the scope of the CRPD. The treaty's broad language demonstrates that it anticipates transformative technologies in addition to emerging ones. For example, Article 2 broadly defines "communication" as including:

> languages, display of text, Braille, tactile communication, large print, accessible multimedia as well as written, audio, plain-language, human-reader and augmentative and alternative modes, means and formats of communication, including accessible information and communication technology. . . .[228]

This definition of communication contemplates forms of augmentative technology to which persons with disabilities must have equal access under Article 1.[229] Moreover, Article 2's definition of "discrimination on the basis of disability" includes "all forms of discrimination,"[230] which contemplates discrimination through neurotechnology, AI, or any other medium.

Article 3(a) mandates "respect for. . .individual autonomy including the freedom to make one's own choices, and independence of persons."[231] The text of this Article alone accounts, loosely, for the importance of informed consent to neurological interventions, including to BCIs, and thereby protects agency and identity. There are currently no general comments available for Articles 1, 2, or 3 – but the Committee on the Rights of Persons with Disabilities may decide to create them to provide a normative framework for neurorights and disability.

### *B. Articles which could be further interpreted to protect against misuse and abuse of neurotechnology*

Articles 4(g) and 9(2)(h) of the CRPD could be further interpreted through general comments to protect against misuse and abuse of neurotechnology.

**Article 4(g)** provides that States parties have an obligation to "undertake or promote research and development of, and to promote the availability and use of new technologies, including information and communications technologies, mobility aids, devices and assistive technologies, suitable for persons with disabilities, giving priority to technologies at an affordable cost."[232] Importantly, Article 4(g) mandates that States undertake or promote research and development, and promotion of availability of "new" technologies, rather than limiting the access of persons with disabilities to assistive technologies. This broad framework anticipates the development of transformative technologies that will benefit persons with disabilities.

However, Article 4(g) fails to specifically mention neurotechnology. Where neurotechnology devices would assist persons with disabilities but are not considered medical devices, ableist attitudes may motivate a State to focus on guaranteeing access to medical devices rather than taking a holistic approach to general neurotechnology access. Such an approach would guarantee persons with disabilities the widest array of technology options. Additionally, Article 4(g) does not explain any problems which should be avoided in the development of assistive

[228] CRPD, *supra* note 214, at Art. 2.
[229] *See Id.*, at Art. 1.
[230] *Id.*, at Art. 2.
[231] *Id.*, at Art. 3(a).
[232] *Id.*, at Art. 4(g).

technology, such as unpredictable or uncontrollable changes in a device user's cognitive abilities and mental identity – or any other ways in which the use of neurotechnology for persons with disabilities may not be a positive development.

**Article 9(2)(h)** implicitly protects equal access to augmentative neurotechnology, but does not provide sufficient protection for identity, agency, or mental privacy. Article 9(h) requires States to promote the design, development, production and distribution of accessible information and communications technologies and systems at an early stage, so that these technologies and systems become accessible at minimum cost."[233] The accompanying general comment to Article 9 notes that new technologies should be "designed or produced in a way that ensures their accessibility."[234] Article 9(2)(h) thereby protects equal access to mental augmentation and protects against algorithmic bias at the development stage of neurotechnology.

Nonetheless, Article 9(2)(h)'s protections of mental agency, identity, and privacy potentially could be strengthened through language noting that the over-recording of data makes devices less accessible and makes persons with disabilities vulnerable to algorithmic bias. The Committee on the Rights of Persons with Disabilities may consider this point with respect to the general comment on Article 9. Further, the Committee may consider using Article 9's general comment to concretely engage with examples of specific, available neurotechnology devices – explaining how they could be made more accessible, or by explaining why they cannot be made accessible. Examples may outline parameters for States' domestic regulation of neurotechnology and could help guide its accessibility at the earliest stages of device development.

### *C. Articles which do not protect against misuse and abuse of neurotechnology*

CRPD anticipates the advent of transformative technologies and their potential impacts on the equality of persons with disabilities. However, CRPD still does not contemplate specific examples of current or future neurotechnology which may infringe upon an individual's identity, agency, and mental privacy. For example, because the CRPD obligates States parties to guarantee the fair access of persons with disabilities to transformative technologies and treatments, persons with disabilities may become some of neurotechnology's most avid users. Consequently, a disproportionately large amount of brain data of persons with disabilities could be insecurely stored or sold to third parties. Identity theft and sharing sensitive data may lead to increased marginalization. Because neurotechnology may be used to treat disabilities, a provision on brain data privacy in a general comment and a thematic report could improve CRPD's protections.

## V. THE INTERNATIONAL CONVENTION ON THE ELIMINATION OF ALL FORMS OF RACIAL DISCRIMINATION

[233] *Id.*, at Art. 9(h).
[234] *General Comment No. 2 on Article 9*, U.N. COMM. ON THE RIGHTS OF PERSONS WITH DISABILITIES, U.N. Doc. CRPD/C/GC/2, May 22, 2014, at ¶ 22, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/G14/033/13/PDF/G1403313.pdf?OpenElement.

The International Convention on the Elimination of All Forms of Racial Discrimination ("CERD") was adopted in 1965 and entered into force in 1969.[235] It was drafted following the Second World War and against the backdrop of new African States emerging from colonial rule and into independence and represented the first codification of the customary international law norm prohibiting racial discrimination.[236] In today's world, AI and the dangers of algorithmic bias highlight the applicability of CERD to protecting human rights against potential infringements by emerging technologies. Indeed, in the *Roadmap for Digital Cooperation*, the Secretary-General specifically emphasizes the dual imperatives to prevent technology from worsening discrimination, and to promote inclusion in its use and accessibility.[237]

Within the realms of neuroscience and neurotechnology, race discrimination is present in myriad ways. For instance, racial discrimination is already present in electroencephalography ("EEG") research, as individual researchers' biases interfere with data collection.[238] To obtain high-quality data from an EEG, in which an electrode adheres to a person's scalp, individual researchers must consider factors such as hair length and hair type. The data selection process risks eliminating people of color from EEG datasets entirely, leaving entire groups of people vulnerable to undiagnosed conditions,[239] such as epilepsy, brain injuries, and stroke.[240]

Today, we are only able to interpret a small amount of the data total contained within an EEG; however, it is possible that we may one day be able to discern a person's race and/or precise thoughts revealing their race – which will lead to increased surveillance, profiling, and inequality. As previously mentioned, one study has already reported 91% accuracy in using EEGs to predict suicidal thoughts.[241] The UN has discussed that the use of AI and digital technologies in policing leads to racist outcomes.[242] Conceivably, similar discrepancies will emerge in medical care, as neurotechnology devices are combined with AI. For consumers, devices which create and store users' EEGs and which fail to fully de-identify their data,[243] such as the Kernel Flow Helmet, may result in the racial profiling of users by companies or governments. And furthermore, groups may be excluded from accessing neurotechnology on racial grounds. Based upon these potential human rights concerns, the largest protection gaps for the CERD are equal access to mental augmentation and protection from algorithmic bias.

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[235] International Convention on the Elimination of All Forms of Racial Discrimination, 660 U.N.T.S. 195, *entered into force* Jan. 4, 1969 [hereinafter CERD].
[236] *Id.*; Barcelona Traction, Light and Power Company, Limited (Belgium v Spain) (New Application: 1962) (Judgement) [1970] ICJ Rep 3 ¶ 34 (finding that the prohibition of racial discrimination is an obligation *erga omnes*).
[237] *Id.*, at ¶ 8; CALL TO ACTION, *supra* note 49, at 12.
[238] Tricia Choy, Elizabeth Baker & Katherine Stavropoulos, *Systemic Racism in EEG research: Considerations and Potential Solutions*, AFFECTIVE SCI., May 26, 2021, *available at* https://link.springer.com/article/10.1007/s42761-021-00050-0.
[239] *Id.*
[240] Jasmine Kwasa, Arnelle Etienne & Pulkit Grover, *Towards True Equity in Neurotechnology*, THE NEUROETHICS BLOG, Dec. 22, 2020, *available at* http://www.theneuroethicsblog.com/2020/12/towards-true-equity-in-neurotechnology.html.
[241] Marcel Just, Lisa Pan & Vladimir Cherkassy, et al., *Machine Learning of Neural Representations of Suicide and Emotion Concepts Identifies Suicidal Youth*, NATURE HUMAN BEHAVIOR (2017), *available at* https://nocklab.fas.harvard.edu/files/nocklab/files/just_2017_machlearn_suicide_emotion_youth.pdf.
[242] Nick Cumming-Bruce, *U.N. Panel: Technology in Policing Can Reinforce Racial Bias*, NEW YORK TIMES, Nov. 26, 2020, *available at* https://www.nytimes.com/2020/11/26/us/un-panel-technology-in-policing-can-reinforce-racial-bias.html.
[243] *Id.*

### *A. Articles which protect against most misuse and abuse of neurotechnology*

Articles 5 and 7 of CERD arguably already protect some of the neurorights. **Article 5** of CERD:

> guarantee[s] the right of everyone, without distinction as to race, colour, or national or ethnic origin, to equality before the law, notably in the enjoyment of the following rights:
>
> > (a) The right to equal treatment before the tribunals and all other organs administering justice;
> > (b) The right to security of person and protection by the State against violence or bodily harm, whether inflicted by government officials or by any individual group or institution;
> > (c) Political rights, in particular the right to participate in elections-to vote and to stand for election-on the basis of universal and equal suffrage, to take part in the Government as well as in the conduct of public affairs at any level and to have equal access to public service;
> > (d) Other civil rights, in particular. . .;
> > (e) Economic, social and cultural rights, in particular. . .;
> > (f) The right of access to any place or service intended for use by the general public, such as transport hotels, restaurants, cafes, theatres and parks.[244]

Article 5 implicitly protects all five enumerated neurorights. When a State imposes a restriction on any right or freedom within Article 5, it must ensure that the restriction is compatible with **Article 1** of the Convention, which defines the parameters of "racial discrimination" in all areas of public life.[245] To the extent that private parties using neurotechnology create restrictions on the exercise or *availability* of the rights enumerated above, States parties to CERD are responsible for ensuring that the result "has neither the purpose nor the effect of creating or perpetuating racial discrimination."[246]

**Article 5(d)** addresses the rights to identity, agency, and mental privacy by prohibiting racial discrimination and by mandating the equality of freedom of thought, conscience, and religion and freedom of expression. **5(e)** addresses the right to protection from algorithmic bias by mandating equal access to medical care and **5(f)** addresses protection from algorithmic bias by guaranteeing equality of access and protection against racial profiling. **However, the CERD does not apply to distinctions made between citizens and noncitizens[247] – and this unprotected distinction, which can in certain country contexts correlate with race, may leave individuals' neurorights beyond the scope of Article 5.**

**Article 7** of the CERD stipulates that:

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[244] CERD, *supra* note 235, at Art. 5.
[245] *General Recommendation No. 20 on Article 5*, U.N. COMM. ON THE ELIMINATION OF RACIAL DISCRIMINATION, U.N. Doc. CERD/48/Misc.6/Rev.2, Mar. 15, 1996, at ¶ 2, *available at* https://digitallibrary.un.org/record/212172?ln=en.
[246] *Id.*, at ¶ 5.
[247] CERD, *supra* note 235, at Art. 1(2)

> States Parties undertake to adopt immediate and effective measures, particularly in the fields of teaching, education, culture and information, with a view to combating prejudices which lead to racial discrimination and to promoting understanding, tolerance and friendship among nations and racial or ethnical groups, as well as to propagating the purposes and principles of the Charter of the United Nations, the Universal Declaration of Human Rights, the United Nations Declaration on the Elimination of All Forms of Racial Discrimination, and this Convention.[248]

In principle, Article 7 represents full coverage of the five neurorights. In championing the development of education and culture which seeks to combat prejudice, Article 7 obligates States parties to develop neurotechnology in the fields of teaching, education, culture, and information with the objective of eliminating racial discrimination.

### *B. Articles which could be further interpreted to protect against misuse and abuse of neurotechnology*

**Articles 2(b)** and **(c)** state that "each State Party undertakes not to sponsor, defend or support racial discrimination by any persons or organizations,"[249] and that States "shall take effective measures to review governmental, national and local policies, and to amend, rescind or nullify any laws and regulations which have the effect of creating or perpetuating racial discrimination wherever it exists."[250]

These subsections of Article 2 protect individuals against neurotechnology's perpetuation of bias and discrimination. However, they make it incumbent upon States to regulate neurotechnology to ensure that devices do not perpetuate racial discrimination. CERD's General Recommendation 24 on Article 1 suggests that neurotechnology that collects demographic data should be developed under the close supervision of national legislators,[251] but the Committee on the Elimination of All Forms of Racial Discrimination should consider making this suggestion explicit to ensure that neurotechnology is programmed in a non-discriminatory way from its inception, rather than retroactively.

Similarly, **Article 4** prohibits the deliberate propagation of racial hatred or bias as committed by either a group or by individuals.[252] However, the contours of state liability are less clear for the brain activity reading or interpretation of a non-invasive BCI that propagates racial discrimination through an algorithm. The Committee should consider further interpreting Articles 2 and 4 to protect neurorights by creating specific parameters for the domestic supervision and regulation of neurotechnology's development.

### *C. Articles which do not protect against the misuse and abuse of neurotechnology*

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[248] *Id*., at Art. 7.
[249] CERD, *supra* note 235, at Art. 2(b).
[250] *Id.*, at Art. 2(c).
[251] *General Recommendation No. 24 on Art. 1*, U.N. COMM. ON THE ELIMINATION OF RACIAL DISCRIMINATION, G.A. Res. A/54/18, Mar. 1999, at ¶¶ 3-4.
[252] CERD, *supra* note 235, at Art. 4.

No articles of CERD entirely fail to apply to neurorights. However, CERD is ill-equipped to anticipate the ways in which BCIs may amplify racial bias. Access to neurotechnology in healthcare settings may be limited by racial bias in neuroscience research, and individuals may unwittingly reveal racial biases to the neurotechnology, such as through a non-invasive BCI which uses machine-learning, which may lead to exclusive preferences for some individuals' brain data over others. Further, while the UN has a robust sense of how surveillance, policing, and algorithmic technologies can perpetuate racial discrimination once they are used, CERD does not contain any provisions describing safeguards for developing technology which is non-discriminatory at its inception. The General Recommendations provide a path forward for interpreting CERD's provisions to include such safeguards.

## VI. CHAPTER VI: THE CONVENTION ON THE ELIMINATION OF ALL FORMS OF DISCRIMINATION AGAINST WOMEN

The Convention on the Elimination of All Forms of Discrimination Against Women ("CEDAW") was adopted in 1979.[253] It has an Optional Protocol enabling the Committee on the Elimination of Discrimination against Women to receive and consider individual communications.[254] **Currently, none of CEDAW's articles, general recommendations, or associated jurisprudence mention neurotechnology.** Its general recommendations entirely fail to mention any kind of technology or data protection.[255] Existing language from the Special Rapporteur on Violence Against Women and Girls may provide a basis for strengthening CEDAW's protections against the misuse and abuse of neurotechnology. However, CEDAW's articles do not.

The Special Rapporteur has observed, "It is important to note from the outset that the Special Rapporteur report does not aim to define and catalogue all forms of online violence against women and girls. The rapid development of digital technology and spaces, including through artificial intelligence (AI), will inevitably give rise to different and new manifestations of online violence against women."[256] In particular, the Special Rapporteur focuses upon the publishing of private data with malicious intent against women and girls.[257] Given that companies may not share brain data maliciously, but rather may be authorized to do so through a consumer user agreement, the protection of women and girls' mental privacy must be more robust to prevent trafficking and stalking.

The Special Rapporteur's report does not catalogue all forms of online violence, but its focus on the Internet precludes full consideration of neurotechnology. The provisions of CEDAW and its general recommendations dangerously do not anticipate the impact of BCIs on women and

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[253] International Convention on the Elimination of All Forms of Discrimination Against Women, 1248 U.N.T.S. 13, *entered into force* Sept. 3, 1981 [hereinafter CEDAW].
[254] Optional Protocol on the Convention on the Elimination of All Forms of Discrimination Against Women, G.A. Res. 54/4, *adopted* Oct. 15, 1999, at Art. 1.
[255] *General Recommendation No. 3*, GENERAL RECOMMENDATIONS OF THE COMMITTEE ON THE ELIMINATION OF ALL FORMS OF DISCRIMINATION AGAINST WOMEN, U.N. WOMEN, *accessed* Nov. 16, 2021, *available at* https://www.un.org/womenwatch/daw/cedaw/recommendations/recomm.htm#recom3.
[256] REPORT OF THE SPECIAL RAPPORTEUR ON VIOLENCE AGAINST WOMEN AND GIRLS, U.N. HUMAN RIGHTS COUNCIL, U.N. Doc. A/HRC/38/47, June 14, 2018, at ¶ 24, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/G18/184/58/PDF/G1818458.pdf?OpenElement.
[257] *Id.*, at ¶ 36.

girls, and the Committee on the Elimination of All Forms of Discrimination Against Women should consider authoring a new general recommendation.

### *A. Articles which could be further interpreted to protect against misuse and abuse of neurotechnology*

Because none of the articles or general recommendations for CEDAW mention neurotechnology, none of its articles currently provide neurorights protection – but none of them provide "zero" applicability to neurorights and to neurotechnology.

**Article 5(a)** obligates States to "modify the social and cultural patterns of conduct of men and women, with a view to achieving the elimination of prejudices and customary and all other practices which are based on the idea of the inferiority or the superiority of either of the sexes or on stereotyped roles for men and women."[258] This obligation may be further interpreted to both prevent the growth of algorithmic bias through early-stage regulation of neurotechnology's development, and to ensure that BCIs which alter brain activity or which change an individual's sense of self do not entrench stereotypes. For example, in a previously discussed 2016 study, a man who had used an implanted electrode to treat his depression for seven years reported that the way in which he interacted with others changed – and disrupted his sense of who he is.[259] Specifically, he considered the way in which he now interacted with others to be "inappropriate."[260] The Committee on the Elimination of All Forms of Discrimination Against Women should create a general recommendation that discusses neurotechnology's impact on stereotyping. This general recommendation would improve CEDAW's protections of identity, agency, and protection from algorithmic bias.

For instance, the helmets used to monitor workers in a Chinese factory measure changes in emotion to assess productivity.[261] This data is fed to artificial intelligence algorithms to detect changes in emotion which affect productivity levels. Stereotyping about gender and productivity, emotional changes, and low productivity could lead to both algorithmic bias as well as to gender discrimination in worker hiring and firing.

**Article 10(a)** implicitly provides minimal protection against algorithmic bias, which speaks to the prohibition on discrimination and the fundamental concern of CEDAW. Article 10(a) requires States to provide the "same conditions for career and vocational guidance, for access to studies and for the achievement of diplomas" to ensure that women have equal rights with men in the field of education.[262] If neurotechnology is used inside the classroom, such as to monitor attention levels of students (with their informed consent), and the analysis of that data is not biased by sex/gender, there is some protection against algorithmic bias.

However, Article 10 of CEDAW does not adequately protect equal access to mental augmentation. The language of "same conditions" implies that women and men should have access

[258] CEDAW, *supra* note 253, at Art. 5(a).
[259] *Four Ethical Priorities*, *supra* note 14, at 162.
[260] *Id.*
[261] VICE NEWS, *supra* note 44.
[262] CEDAW, *supra* note 253, at Art. 10(a).

to the same technology so long as it is a condition of education. The Committee might clarify the meanings of condition of career and vocational guidance in a general recommendation.

### *B. Ways to strengthen CEDAW's protections against potential misuse and abuse of neurotechnology*

New general recommendations are sorely needed to enhance CEDAW's protections for neurorights and against all potential misuse and abuse of neurotechnology. Thematic reports for the Special Rapporteur on Violence Against Women and Girls which address neurotechnology (both online and offline) may generate discussion at the Committee which results in new general recommendations.

## VII. THE CONVENTION ON THE RIGHTS OF THE CHILD

The Convention on the Rights of the Child ("CRC") was adopted in 1989 and entered into force in 1990.[263] Its Optional Protocol enables the Committee on the Rights of the Child to receive and to consider individual communications.[264] **Currently, none of CRC's articles or associated jurisprudence mention neurotechnology.** However, General Comment No. 25, which was published this year on children's rights in relation to the digital environment, notes that

> States parties should prohibit by law the profiling or targeting of children of any age for commercial purposes on the basis of a digital record of their actual or inferred characteristics, including group or collective data, targeting by association or affinity profiling. Practices that rely on neuromarketing, emotional analytics, immersive advertising and advertising in virtual and augmented reality environments to promote products, applications and services should also be prohibited from engagement directly or indirectly with children.[265]

To the extent that neurotechnology involves the storage and the sale of brain data for advertising purposes, this technology is prohibited from engagement directly or indirectly with children. However, the scope of neuromarketing technologies should be more clearly defined to enable countries to develop adequate data privacy and identity/agency protections for children. The Special Rapporteur on the Sale of Children, Child Prostitution and Child Pornography has indicated that because children are among those "most familiar" with new technologies, they are most vulnerable to potential harm, such as targeting advertising.[266] While there are obvious risks, including traffickers who could "hack" neuro data to identify children as they browse online or to target them as victims, there are protection gaps for children that the CRC could address.

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[263] Convention on the Rights of the Child, 1577 U.N.T.S. 3, *entered into force* Sept. 2, 1990 [hereinafter CRC].
[264] Optional Protocol to the Convention on the Rights of the Child, G.A. Res. 66/138, *entered into force* Apr. 14, 2014, at Art. 1.
[265] *General Comment No. 25 on the Rights of Children in Relation to the Digital Environment*, U.N. COMM. RIGHTS OF THE CHILD, U.N. Doc. CRC/C/GC/25, Mar. 2, 2021, at ¶ 42, *available at* https://documents-dds-ny.un.org/doc/UNDOC/GEN/G21/053/43/PDF/G2105343.pdf?OpenElement.
[266] REPORT OF THE SPECIAL RAPPORTEUR ON THE SALE OF CHILDREN, CHILD PROSTITUTION AND CHILD PORNOGRAPHY, U.N. HUMAN RIGHTS COUNCIL, U.N. Doc. A/HRC/28/56, Dec. 22, 2014, at ¶ 20, *available at* https://www.ohchr.org/EN/HRBodies/HRC/RegularSessions/Session28/Documents/A_HRC_28_56_ENG.doc.

### *A. Articles which could be further interpreted to protect against misuse and abuse of neurotechnology*

**Articles 8(1) and (2)** require that "States Parties undertake to respect the right of the child to preserve his or her identity, including nationality, name and family relations as recognized by law without unlawful interference,"[267] and explain that "[w]here a child is illegally deprived of some or all of the elements of his or her identity, States Parties shall provide appropriate assistance and protection, with a view to re-establishing his or her identity."[268] The Committee on the Rights of the Child may consider further interpreting these provisions through its general comment to provide protection for the neuroright of identity.

The Committee also might indicate that wherever technology infringes upon a child's identity, a State is obligated to assist and to protect the child. This is a critical gap in protection that the CRC might consider for existing and future examples of neurotechnology. No BCI may be implanted in a child or put on a child without a parent or legal guardian's informed consent, but a child's rights to identity, agency, and mental privacy still may not be fully protected in all environments. For instance, when BrainCo developed the Focus1 headband to monitor primary school students' attention levels in the classroom,[269] there was domestic backlash in China from parents of students, and the program was, reportedly, subsequently disbanded.[270] However, as discussed in Chapter III on the ICESCR, the use of BCIs in the classroom may not be wholly unfettered, even with the informed consent of parents and legal guardians. BCIs' use in the classroom also must comply with other provisions under international human rights law, such as the ICESCR's Article 13 requirements on the right to education.

Additionally, Article 8(1) does not specify whether a child's identity includes the child's mental faculties, which the Committee on the Rights of the Child should consider placing into this Article's text or a general comment. General Comment No. 25 stipulates that States must proactively protect children from materials which damage their mental health, and from the risks of mental violence in a digital environment.[271] This General Comment might be further interpreted, such that it specifies that States must regulate neurotechnology's development and use with the protection of children.

The Committee also might consider further interpreting **Articles 17 and 19** through general comments to better protect the formation of children's identities. Article 17 requires children to have access to an array of sources concerning mass media and the dissemination of information.[272] Article 19 ensures that States take appropriate domestic measures to protect children from mental violence and exploitation – and that such protective measures include effective procedures for the identification, reporting, referral, investigation, treatment, and follow-up of instances of child maltreatment.[273]

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[267] CRC, *supra* note 263, at Art. 8(1).
[268] *Id.*, at Art. 8(2).
[269] Li, *supra* note 211.
[270] *Id.*
[271] *General Comment No. 25 on the Rights of Children in Relation to the Digital Environment*, *supra* note 265, at ¶¶ 82, 96.
[272] CRC, *supra* note 263, at Art. 17.
[273] *Id.*, at Arts. 19(1)-(2).

Articles 17 and 19 highlight the CRC's awareness that children are vulnerable to exploitation and interference during the process of identity formation, developing opinions, and building and maintaining physical and mental health. Interpreting Article 17(e) to include guidance on protecting children from forced or uninformed consent to interference with their brain activity may help States improve their national legal and regulatory frameworks to govern the development of neurotechnology which is safe for children. These considerations could broadly apply to children with disabilities and children deprived of liberty too. Indeed, General Comment No. 25 calls upon States parties to respect the "evolving capacities" of the child – which must be done without discrimination.[274]

### *B. Ways to strengthen CRC's protections against potential misuse and abuse of neurotechnology*

Broadly interpreting the words "violence" and "injury" which appear in Article 19(1) would provide a basis in international human rights law for considering the impact of neurotechnology on children's developing brains and would help chart a path forward for measures which identify, help report, refer, and investigate instances of child maltreatment. While General Comment No. 25 already protects children from interferences with their opinions in the digital environment,[275] tracing neurotechnology's impact on a child is much more challenging.

General Comment 25 on the rights of children in the digital world might be the closest any existing UN human rights document has come to capturing the future challenges of neurotechnology. It recognizes the 'evolving capacities' of the child, identifying the importance of a process of identity formation built upon a child's right to receive and to impart information. The Internet threatens that process in similar ways to neurotechnology. Rather than developing opinions based upon online content, children of the future may find that their identities and opinions develop based upon their interactions with brain-reading and brain-writing BCIs.

## CONCLUSION

Ultimately, existing international human rights treaties are currently unprepared to protect neurorights. Nevertheless, as described in detail in our findings, rapid advances in neurotechnology are no longer science fiction – they are science. It is urgent that the UN play a leading role globally to embrace these exciting innovations while protecting human rights and ensuring the ethical development of neurotechnology.

[274] *General Comment No. 25 on the Rights of Children in Relation to the Digital Environment*, *supra* note 265, at ¶¶ 19-20.
[275] *Id.*, at ¶ 61.