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OUTCOME DOCUMENT OF THE FIRST MEETING OF THE AHEG

FIRST DRAFT OF A RECOMMENDATION ON THE ETHICS OF NEUROTECHNOLOGY (FIRST VERSION)

In line with the decision of UNESCO's General Conference at its 42nd session (42C/Resolution 29), the Director-General constituted an Ad Hoc Expert Group (AHEG) for the preparation of a draft text of a Recommendation on the ethics of Neurotechnology in April 2024.

The AHEG held its first meeting from 22 to 26 April 2024, at the UNESCO Headquarters in Paris and produced the first version of the first draft of the Recommendation on the Ethics of Neurotechnology, contained in this document.

It is underlined that this first version of a draft text will continue to be revised by the AHEG until the beginning of September 2024, taking into account the feedback received during the multi-stakeholder consultation process to be held from June to July 2024.

This document does not claim to be exhaustive and does not necessarily represent the views of the Member States of UNESCO.

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[To be completed at a later stage.]

II. DEFINITIONS AND SCOPE OF APPLICATION

II.1. Definition

1. This Recommendation addresses ethical issues related to the domain of neurotechnology to the extent that they are within UNESCO's mandate. It approaches neurotechnology ethics as a systematic normative reflection based on a holistic, comprehensive, multicultural, and evolving framework of interdependent values, principles, and actions that can guide societies in dealing responsibly with the known and unknown impacts of neurotechnology on human beings, societies, and the environment and ecosystems. It considers ethics as a dynamic basis for the normative evaluation and guidance of neurotechnology, referring to human dignity, well-being, and the prevention of harm as a compass and as rooted in the ethics of science and technology. This Recommendation draws upon a full range of scholarship, commentary and view from neuroscience, medicine, engineering, psychology, ethics, law, sociology, anthropology, psychology, and a whole range of disciplines.

2. Neurotechnology refers to devices and procedures used to understand and/or influence, access, monitor, assess, emulate or modulate the structure and function of the nervous systems of human beings and other animals. While neurotechnology has great potential to significantly enhance human experiences and functioning, it also raises important ethical, legal and societal concerns related to security, mental privacy, cognitive liberty, agency and human autonomy.

3. Scientific evidence demonstrates that nervous system activity is the basis of sensory, motor, and mental states. The nervous system activity includes the central (brain, spinal cord) and peripheral (somatic, autonomic, enteric) nervous system. Mental states include [but are not limited to] cognitive, affective, and conative states. The nervous system also supports consciousness and the experience of pain. The nervous system activity provides information inherent to all human beings regardless of gender, ethnicity, language, or religion. The nervous system activity is also instrumental in social and cultural interactions, leading to consideration of both the individual and the community when collecting information about it.

4. Neurotechnology can be used in medical as well as non-medical applications. It includes but is not limited to:

a. Technical tools that measure and analyse chemical, physical, acoustic, electrical, magnetic and/or mechanical signals associated with the structure of and functional signals from the nervous system. These may be used to identify, record, and/or monitor properties of nervous system activity, understand how the nervous system works, diagnose pathological conditions, or control external devices (nervous system machine interfaces being often referred to as brain computer interfaces (BCI)).

    (i) Examples include Electroencephalography (EEG), Magnetoencephalography (MEG), Magnetic resonance imaging (MRI), Functional Magnetic resonance imaging fMRI, Positron emission tomography (PET), Near-infrared spectroscopy (NIRS), Functional Near-infrared spectroscopy (fNIRS), Implanted microelectrodes, Optogenetics, Optical imaging, Diffusion tensor imaging (DTI), Calcium imaging, Voltage dye sensors, or Microdialysis.

b. Technical tools that interact with the nervous system to change its activity, for example, to restore sensory input, such as hearing (i.e. cochlear implants) or Deep Brain Stimulation (DBS) to treat tremors and other pathological conditions. These tools are designed to record signals from the nervous system and 'translate' them into technical control commands and/or to modify nervous system activity by applying electrical, magnetic, chemical, mechanical, or optical stimuli. They are meant to either modulate the functions of the nervous system and/or send signals directly to the nervous system by applying electrical, magnetic or optical stimulation of the peripheral or central nervous system.

    (i) Examples of this neurotechnology are implanted microelectrodes, Brain-Machine Interfaces (BMI), Deep brain stimulation (DBS), Optogenetic optical stimulation, Transcranial Direct or alternate current stimulation (tACS, tDCS), Transcranial Magnetic Stimulation (TMS) or Neuropharmacological infusion.

5. More generally, neurotechnology includes any biosensor technologies that measure or monitor an individuals' physiological or behavioural activities, which could be used to infer sensory, motor, and menta states.

a. Examples of this neurotechnology are Eye-tracking, Video Oculography, Typing dynamics, Voice recognition and analysis, Gait analysis, Skin conductance, Heart rate variability, Sleep movement monitoring, Blood pressure measurement, or facial-emotion recognition systems.

6. Central to neurotechnology issues are the handling, analysis, treatment, storage, use and reuse of the data collected from a given individual.

7. ***Neural data*.** Neural data are quantitative data about the structure, activity and function of the nervous system of a living organism. They encompass data relating to a nervous system's activity, including both direct measurements of neuronal structure, activity and/or function (e.g., neuronal firing or summed bioelectric signals from EEG) and indirect functional indicators (i.e., blood flow in fMRI and fNIRS). At the neurobiological level, neural data are the most direct correlates of mental states, as all cognitive and affective activity is primarily processed in the nervous system. Therefore, the prospect of decoding or modifying neural activity implies the possibility of decoding or modifying cognitive and affective processes.

8. ***Cognitive Biometric Data*.** Neural data, as well as other data collected from a given individual or group of individuals through other biometric and biosensor data, can be processed and used to infer mental states, which we describe herein as "cognitive biometric data". The processing of neural data and other biosensor data, especially if supported by AI techniques, may allow inferences about cognitive, affective and conative states (hereinafter "mental states") of the individual. Cognitive biometric data therefore includes not only neural data, but also inferences about mental states made through the processing of other biosensor data.

9. ***Whole life cycle***. Neurotechnology should be considered from the early stages of research, design and development to deployment and use, including maintenance, operation, trade, financing, monitoring and evaluation, validation, end-of-use, disassembly, and termination. (as referenced in the Recommendation on the Ethics of Artificial Intelligence).

10. Considering the whole life cycle of neurotechnology is a way of identifying the actors that are involved in any stage, in addition to ensuring the protection of the general public and diversity in teams and populations, would also be involved in every stage, along with the technical and professional specialists.

II.2. Scope

11. The use of neurotechnology may fundamentally affect human rights by directly affecting the nervous system in aspects such as perception and motor or mental activities.

12. This Recommendation has been undertaken in light of the rapid development of neurotechnology and its convergence with other technologies including spatial computing, XR, and artificial intelligence.

13. The field of applications of the present Recommendation includes measurement, recording and/or modification of nervous system structure, function, activity and behaviour. It can also include, more broadly, any device and/or application able to directly derive knowledge of an individual's nervous system activity and/or influence/modify an individual's nervous system. This Recommendation will also consider any technical tools collecting biometric information that can be used to make inferences about sensory, motor, and mental states have potential consequences on individuals' brain structure, activity and functions. Of note, for some biometric data, the context and purpose of collection and inference may lead to the device being considered 'neurotechnology' for purposes of this Recommendation, even if it is not their primary use.

14. This Recommendation focuses on humans only, although many important considerations apply to animals but are beyond its scope.

15. The present Recommendation considers neurotechnology through health-related applications, as well as commercial, non-medical direct-to-consumer (DTC) neurotechnology (such as well-being devices, neurogaming, etc.), driver safety applications, education, or any other field of application.

III. OUR APPROACH

III.1. Aims and objectives of this Recommendation

16. This Recommendation has been co-created with the aim of guiding the development and use of neurotechnology in ways that are reliable and for the good of humanity, individuals, communities, societies (including the environment and ecosystems), and to prevent harm in the present and the future.

17. Furthermore, it intends to bring a globally accepted normative instrument that focuses not only on the articulation of values and principles, but also on their practical realisation, through concrete policy recommendations and implementation plans that will be impactful for the global community.

18. Global and intercultural dialogue have been considered essential in developing this instrument and ensuring its relevance for all actors.

19. The objectives of this Recommendation are: (i) to guide the actions of individuals, groups, communities, institutions and private sector companies to ensure the embedding of ethics in all stages of neurotechnology development and use (ii) to provide a universal framework of values, principles and actions to guide Member States in the formulation of national legislation, policies or other instruments regarding neurotechnology, consistent with international standards (iii) to protect, promote and respect human rights and fundamental freedoms, human dignity and equality, including gender equality, and to respect cultural diversity in all stages of neurotechnology development and use; (iv) to foster multi-stakeholder, multidisciplinary and pluralistic dialogue and consensus building about ethical issues relating to neurotechnology development and use; (v) to promote equitable access to developments

and knowledge in the field of neurotechnology and the sharing of benefits.

III.2. Ethics of neurotechnology: a human-centred approach

20. While the advancement of neurotechnology is a major source of potential benefits for health and human flourishing, its development and use are raising and will raise in the near future significant ethical challenges at the individual, community, and global level.

21. Neurotechnology is unique in terms of the immediacy and magnitude of its potential to allow access to and modification of neural processes and mental states.

22. As the coordinating centre of behaviour and cognitive-affective processes, any intervention involving the nervous system is of particular ethical, societal and human rights significance. Furthermore, important ethical principles such as self-determination, agency, responsibility, personal autonomy, relational intelligence, and empathy are deeply rooted in mental functions.

23. Human beings are rational and social animals: the nervous system enables and supports the cognitive and affective capacities that make us human. Our highly complex nervous system is also a fundamental factor in our ability to conceive values and care about those values. It enables us to act as moral agents, be responsible for our actions, cooperate with others, deliberate about collective decisions, feel empathy, and develop our personality.

24. From a biological perspective, the development of the nervous system is decisive for the belonging of the individuals to the human species. However, to truly embody humanity, the human brain requires interactions with other human brains. These interactions encompass the acquisition of both verbal and non-verbal languages, as well as the processes of learning and memory. Encapsulated in the philosophy of ubuntu, we can affirm: "I am because we are." In this way we can recognize the agency also in its collective dimension as part/result of a broader sense of individual existence in their belonging to a community.

25. This Recommendation embraces a human-centred approach through fundamental ethical principles including but not limited to self-determination, freedom of thought, responsibility, privacy, personal and collective identity, fairness, trust, respect, reciprocity, and justice. Furthermore, it should be based on the promotion and protection of human rights.

III.3. Ethical challenges in neurotechnology

26. With its increasing ability to access individual neural and cognitive biometric data, neurotechnology raises issues pertaining to the difficulty of anonymizing data and the possibility of identifying persons beyond the original context of data collection, the risk of stigmatization/discrimination based on this data, and revealing neurobiological correlates of diseases, disorders, or general mental states without the authorization of the person from whom data are collected.

27. With its increasing ability to influence neural processes and mental, neurotechnology poses potential threats to personal identity and agency, raises worrying prospects of (i) implicit coercion due to power imbalance and competitive disadvantage (e.g., in the workplace), (ii) modulation of individual behaviours in unexpected, unwanted, and/or unconsented ways.

28. The convergence of advances in AI with neurotechnology raises particular risks related to algorithmic bias, lack of transparency, and risks to mental privacy of individuals. It increases the possibility of manipulation and profiling.

29. At the societal level, the development of neurotechnology might be accompanied by

unequal access to it and unfair distribution of its benefits due to (i) unequal economic resources, the currently distorted distribution of R&D effort on neurotechnology (with most patents being concentrated in a few countries), (ii) unequal participation in the technology design, (iii) potential exploitation of community resources and indigenous knowledge (e.g., of medicinal plants and knowledge).

30. The temptation to embrace neuroenhancement may lead to the risk of not only unexpected damage to the nervous system but also to amplified biological- and technologically-based inequalities within society, threatening the very concept of humanity.

31. Non-inclusive technological development and standardisation may drive a trend toward a homogenization process and the dominance of neurotypicality and capacities that may represent supplementary threats to cultural and collective identity.

32. Neurotechnology-related risks may emerge both at the individual and group level. Group-level risks include group manipulation and group-level privacy and discrimination based on the identification of common neurobiological features.

33. Excessive enthusiasm in the marketing of neurotechnology development can turn into misconduct in neuroscience and neurotechnology innovation.

34. At the global level, the uncontrolled development of neurotechnology for non-medical purposes might lead to disproportionate consumption of resources and energy and waste production.

IV. VALUES, PRINCIPLES AND RIGHTS

IV.1. Values

IV.1.1. Respect, protection and promotion of human rights fundamental freedoms and human dignity

35. The inviolable and inherent dignity of every human constitutes the foundation for the universal, indivisible, inalienable, interdependent and interrelated system of human rights and fundamental freedoms. Therefore, respect, protection and promotion of human dignity and rights as established by international law, including international human rights law, is essential for the use of neurotechnology. Human dignity relates to the recognition of the intrinsic and equal worth of each human being, regardless of race, colour, descent, sex, gender, age, language, religion, faith, or beliefs, neurobiological and mental characteristics (features), political opinion, national origin, ethnic origin, social origin, economic or social condition of birth, or disability and any other grounds.

36. Human rights and fundamental freedoms must be respected, protected and promoted throughout all uses of neurotechnology. Governments, private sector, civil society, international organisations, technical communities and academia must respect human rights instruments and frameworks in their interventions in the processes surrounding the creation and use of neurotechnology.

37. Particular, but not exclusive focus should be devoted to the promotion and protection of the specific human rights relating to a person’s brain and mental experiences (sometimes referred to as ‘neurorights' and/or ‘cognitive liberty’ (IBC 2021, 17)). This bundle of rights should be contextualized within the context of existing human rights to further strengthen, not diminish, the international human rights framework. To do so, balanced assessments of rights inflation and deflation need to be conducted and deliberative processes need to be based on conceptual clarity, rigorous doctrinal analysis and democratic consensus.

38. No human being or human community should be harmed or subordinated, whether physically, economically, socially, politically, culturally or mentally, by the use of neurotechnology. Throughout the life cycle of neurotechnology from design, development and implementation of neurotechnology systems, the quality of life of human beings should be protected and promoted, while what constitutes “quality of life” should be left open to individuals or groups, as long as there is no violation or abuse of human rights and fundamental freedoms, or the dignity of humans in terms of this definition.

39. The use of neurotechnology in the care or assistance of vulnerable people across the entire lifespan of people in vulnerable situations, including but not limited to children, older persons, persons with physical and cognitive disabilities or the ill, should never objectify them, nor undermine their dignity, human rights or fundamental freedoms.

IV.1.2. Promoting human health and wellbeing

40. Available resources should be prioritized for developing medical neurotechnology aimed at preventative, diagnostic, therapeutic or assistive purposes aligned with human wellbeing over consumer recreational and marketing-oriented applications.

41. Neurotechnology used for health purposes should consider health holistically, i.e., as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

42. In contexts requiring resource allocation, the benefits to the worse off (including but not restricted to people with neurological disorders, mental illness and/or physical and cognitive disability) should be given priority.

IV.1.3. Enjoying the benefits of scientific-technological progress and its applications

43. Responsible scientific research and innovation focusing on the design, development and implementation of neurotechnology is essential for the promotion of human health and wellbeing and should aim at the promotion of human rights.

44. Scientific research and development focusing on neurotechnology should be transparent, comply with the best standards of evidence and aligned with international principles of responsible conduct of research and scientific integrity. This requires, among other things, clinical trials involving neurotechnology applications comply with guidelines on the pre-registration of trials, fair selection of participants, approval by independent ethics committees and responsible and transparent communication of the scientific findings.

45. Benefits resulting from neuroscientific and neurotechnological research and its applications should be shared with society as a whole within the international community, in particular with developing countries and contexts with limited resources. Benefits may include assistance to the groups that have taken part in research, access to quality of care, provision of new diagnostic, therapeutic and assistive modalities, access to scientific and technological knowledge, capacity-building facilities for research purposes etc.

46. Access to neurotechnology that contributes to human health and wellbeing should be equitable. The benefits of these technologies should be fairly distributed across individuals and communities globally. Efforts, including international cooperation, should be made to overcome, and never take advantage of, the lack of necessary technological or medical infrastructure, education and skills, as well as ethical-legal frameworks, particularly in lower-middle-income countries (LMICs), least developed countries (LDCs), land-locked developing countries (LLDCs) and small island developing States (SIDS), affecting communities.

47. The development and impact assessment of novel neurotechnology should consider the implementation of human-centred paradigms in which end-users are not merely passive recipients of the technologies but active co-shapers on equal footing. This also includes citizen science activities in which users participate in conducting scientific research.

IV.1.4. Ensuring and respecting diversity and inclusivity

48. Respect for diversity and inclusivity must be upheld at every stage of the lifecycle of neurotechnology. Special consideration should be given to minority groups and underrepresented voices.

49. Individuals and groups should have the freedom to make lifestyle choices, express beliefs and opinions, share personal experiences, and participate in co-designing technologies without restrictions.

50. Neurotechnology, in its interface with other technologies such as artificial intelligence (AI) should not be used to profile, target or exploit people based on their characteristics. This use should be particularly avoided/prohibited in the context of vulnerable individuals and groups.

51. Given that widely recognized neurotechnological innovation largely occurs in the urban well-resourced sector, specific attention to underserved and historically marginalized people is vital to protect against bias, continuous disparities in healthcare, persecution, stigma, neglect, and disrespect. Technological colonization through loss of culture and heritage, therefore, is a substantive threat that must be avoided.

52. Noting that youth are a specific strategic target population for the uptake of consumer products, the protection of their overreliance on neurotechnology at the risk of losing personal identity, social capabilities, and intuition, requires specific professional, educational, and possibly regulatory measures.

53. Aging can lead to disability and dependence as time goes by. Neurotechnology can be used as an assistive, adaptive, and rehabilitative technology. Many researchers have suggested transdisciplinary approaches to address the problem of aging and its effects on activities of daily living. Healthy older adults and elderly patients may have difficulties in communicating, concentrating, memorizing, talking, walking, or maintaining balance. These deficits may lead to inability to communicate with their family, climb stairs, remember new information, or drive safely. Most elderly need to use assistive technologies to better perform daily-life activities. Neurotechnology offers the promise of greatly enhancing elderly' quality of life by considerably improving their personal autonomy and mobility.

54. The strategic target population of the elderly similarly requires protections for human care and, in the case of neurodegeneration, retention of memory, cognition, emotion, and executive challenges. The inclusion of women and people of varying genders is vital to all research and clinical trials.

IV.1.5. Consideration for cross-cultural perspectives on human knowledge and its sharing

55. Respectful knowledge sharing on themes related to the human nervous system and its function between communities and cross-cultural contexts enables humanity to exchange beneficial consequences of epistemic efforts.

56. Sharing knowledge contributes to establishing relationships of trust between different communities and cultures. Community engagement and the reciprocity of exchanges also

contributes to the cohesiveness of humankind in the pursuit of health and quality of life.

57. Many groups seem as of special interest for scientific studies and for its technological applications because of cultural, biological or mental diversity. Indigenous and traditional knowledge, as well other epistemic manifestations of groups must be respected, and any kind of knowledge sharing, or research must assure that it is the result of those groups´ decision and made in their own interest and benefit.

IV.1.6. Living in peaceful, fair and just societies

58. The use of neurotechnology should never undermine freedom of thought and mental self-determination, and mental privacy especially in contexts where the refusal to use the technology may generate a competitive disadvantage or a risk of implicit coercion.

59. The use of neurotechnology should be particularly scrutinized to avoid uses that segregate, objectify or subordinate individuals or communities, reduce social cohesion by exacerbating pre-existing inequalities or generating novel inequalities at the cognitive level, divide and turn individuals against each other, and thereby threaten the coexistence between humans, other living beings and the natural environment.

IV.1.7. Solidarity

60. All actors in the development, deployment and use of neurotechnology should stand in solidarity to call for accountability in instances where neurotechnology may be misused in ways that threaten human rights.

61. The recommendations on ethical development, deployment, and use of neurotechnology should be encouraged to be accepted by all actors.

IV.1.8. Sustainability, Responsibility, Accountability, Responsivity

62. Materials that are used for neurotechnology can be difficult to mine and the process is harmful to the environment (e.g., lithium used for batteries). Both first- and second-generation devices will have an end of life and become toxic waste. When devices require replacement, they cannot be considered environmentally safe or sustainable. Similarly, devices that require accessories are subject to the same concerns. Comprehensive policies should minimize environmental impact and promote recycling and safe disposal practices, ensuring that waste management does not adversely affect human health or ecosystems.

63. Advances in neurotechnology may introduce further requirements such as software updates that can be made unsustainable if performance exceeds that of the original innovation. Interoperability is positive for sustainability. Energy costs of computation, processing and storage (e.g., terabytes of data), small scale nanotechnologies, biodegradability and convergent technologies (EEG + AI) add further complexities to this landscape.

64. All stakeholders involved in the development, deployment, and management of neurotechnology should consider accountability as a central value.

65. This involves adherence to regulatory and professional standards, ensuring that all activities respect personal privacy, dignity, and environmental sustainability. This includes ethical safety measures and the integration of designs that facilitate disassembly, recycling, and recovery of precious materials at the end of the product's lifecycle.

66. It is crucial that actors in the neurotechnology field are responsive to feedback and transparent about new evidence that may necessitate adjustments in technologies or practices. This ensures that neurotechnology continuously respects user rights and adapts to evolving knowledge and environmental needs.

67. The following points outline additional core areas of focus:

a. **Ethics and Oversigh**t: develop stringent ethics review processes for industries currently lacking oversight. This should include international regulations to standardize reporting of device complications, failures, and feedback to ensure continuous improvement.

b. **Accountability for Violations**: establish robust regulatory frameworks to hold violators accountable for ethical breaches, such as unauthorized data use, disregard for privacy, or inappropriate data storage. These frameworks should be enforced by respective governmental and state bodies to maintain high ethical and legal standards in the use of neurotechnology.

c. **Respect for indigenous people and lands**: ensure the protection of and consultation with indigenous people with respect to Indigenous lands (mining) and rights (knowledge, protection of communal rights and privacy) in the extraction of mining materials for neurotechnology from lands with scarce resources.

IV.2. Ethical Principles and Human Rights

IV.2.1. Beneficence, Proportionality and Do No Harm

68. By promoting health, awareness, and wellbeing about people's nervous system and its mental functions, safe and effective neurotechnology can empower people to make competent decisions about their brain and mental health and develop a better understanding of themselves.

69. Neurotechnology could and should contribute to human flourishing in conjunction with non-technological mechanisms and processes such as medicine, welfare, education procedures for risk assessment and mitigation should be implemented to anticipate, preclude or at least mitigate any harms to human beings, human rights and fundamental freedoms.

70. The principles of proportionality, balance and legitimacy should govern the use of neurotechnology and the data it enables, to ensure their use are: : (a) appropriate and proportional to the objective and expected benefits that is aimed to be achieved; (b) do not infringe upon the foundational values of this document; (c) appropriate to the context and target user group; (d) based on safety principles and rigorous scientific evidence.

IV.2.2. Self-determination and Freedom of Thought

71. Throughout the entire lifecycle of neurotechnology, the protection and promotion of people's fundamental rights and freedom to self-determination, should be secured.

72. In the interaction of a human being with a neurotechnology application, the protection of freedom of thought of the person should cover both the *forum externum*, i.e., the expression or manifestation of thought through behaviour, and the *forum internum*, i.e. the underlying neurobiological, sensory, motor, mental state processing. This holistic interpretation of freedom of thought to secure against interpretation, manipulation and punishment for robust thought ensures the protection from undue interference with this aspect of cognitive liberty both at the level of internal neurobiological and mental processing, as well as at the level of externalizing those processes within society through verbal speech, activity or other behaviour.

73. People should have the right to self-determination to make free, informed, and voluntary decisions about whether they want to use a certain neurotechnology application or refuse to do so. These individual decisions, however, should be balanced against considerations relating to

societal and collective wellbeing.

74. Measures should be taken to ensure that the neurotechnology lifecycle (i.e battery lifespan, operating system up-date, etc..) is not advertently or inadvertently used to exert undue influence or manipulation of a person's neurobiological, sensory, motor, cognitive and affective processing in ways that interfere with their freedom of thought and self-determination.

IV.2.3. Mental Privacy and the Protection of Neural Data

75. Mental privacy is essential to the protection of human dignity, personal identity, agency, intimacy, meaningful relationships, and social interactions. Information concerning the human nervous system and its functions, particularly mental functions such as memory, reasoning, decision-making and emotions, is of particular ethical, societal and human rights significance because it is constitutive of the human experience. Care must be taken to engage with individuals to ensure that information is collected with their consent and in ways that they understand. Furthermore, fundamental ethical principles such as agency, responsibility, personal autonomy, and empathy are deeply rooted in mental functions. Therefore, neural data must be collected, processed, shared, stored, and deleted in ways that are consistent with international law and ethical guidelines and are in line with the values and principles outlined in this Recommendation, while respecting relevant national, regional, and international legal frameworks.

76. Given the diverse applications of neurotechnology and the implications of neural and cognitive biometric data analysis, mental privacy encompasses the inferences drawn by automated systems from such data.

77. Likewise, mental privacy could be compromised by the aggregation of neural and cognitive biometric data with other digitally available sources, prompting the need to consider strategies for preventing misuse or unauthorized access.

IV.2.4. Trustworthiness

78. Neurotechnology systems for human use should always ensure trustworthiness across their entire life cycles. This requires, among other things, that (a) these systems do not replicate or amplify biases, (b) are transparent, traceable and explainable, (c) are grounded on solid scientific evidence, (d) and define clear conditions for responsibility and accountability.

79. The transparency of neurotechnology systems and neurotechnology-related procedures are preconditions to ensure the respect, promotion and protection of human rights and fundamental freedoms.

80. Human oversight and accountability should be maintained. While the automation of processes can lead to better functional outcomes, adequate oversight and due diligence mechanisms should always be in place to ensure accountability for neurotechnology systems and avoid conflicts with human rights and values.

IV.2.5. Fairness and Non-Discrimination

81. All actors involved in any stage of the neurotechnology lifecycle should avoid reinforcing or perpetuating discriminatory or biased applications. Neurotechnology should not reiterate or amplify pre-existing discriminatory practices or introduce new forms of discrimination based on neurological or neuropsychological characteristics. A person's mental information or information concerning the predisposition to develop a neurological or psychiatric disorder should not be used to determine decisions related to employment, health insurance etc. unless this poses a risk to the person at stake, other groups or social safety.

82. From a global justice perspective, neurotechnology should not exacerbate or amplify pre-existing inequalities between individuals, groups, or countries. Furthermore, it should not create new inequalities based on cognitive or other neurobiological features.

83. Equitable Access should be prioritized to ensure that neurotechnology is accessible worldwide, regardless of socioeconomic status or geographical location, particularly in low- and middle-income countries (LMICs) and resource-constrained settings, with particular consideration for the needs of people with disabilities, neurological disorders and mental illness.

84. To ensure a fair and equitable distribution of the benefits of neurotechnology, it is imperative to take into consideration the specific needs of different patient groups, age segments, cultural systems, language communities, as well as marginalized and vulnerable people or people in vulnerable situations.

85. Ethics of responsible innovation should guide lowering the cost of hardware components and promoting the use of non-proprietary software to enhance accessibility.

IV.2.6. Epistemic and Global Justice

86. Public awareness of brain and mental health and understanding of neurotechnology and the importance of neural data should be promoted through open and accessible education, public engagement, training, capacity-building, and science communication.

87. Effective public engagement and respect for diversity necessitate consideration of linguistic, social, and cultural diversity. These elements are crucial to upholding the principles of autonomy and self-determination.

88. Learning about the impact of neurotechnology should include learning about, through and for human rights and fundamental freedoms, meaning that the approach and understanding of neurotech should be grounded by their impact on human rights and access to rights.

89. Meaningful community engagement must ensure collective decision-making and respect for communities' values, heritage, culture and identity.

IV.2.7. Interests of the Child and Protection of future generations

90. Childhood and adolescence are rapidly changing and life-defining periods of development of the brain. It is crucial to preserve the future rights of children and adolescents to make autonomous decisions, as well as their privacy. Technology should be assessed to ensure the best interests of and the flourishing of the child as an evolving intuitive person.

91. From an ethical perspective, it is important to balance the potential benefits of enhancing cognitive function through neurotechnology for early diagnosis, instruction, education, and continuous learning with a commitment to the holistic development of the child. This includes nurturing their social life, fostering meaningful relationships, and promoting a healthy lifestyle encompassing nutrition and physical activity.

92. From an ethical perspective, it is imperative to regulate research experiments to ensure they do not involve children without informed consent and assent. Consideration should be given to social trends (e.g., pressure of social media on young people) and changing societal perceptions about increased recognition of the decision-making capacities of children. Even when using non-invasive and harmless neurotechnology, justification for their participation must be carefully assessed, considering the vulnerability of the developing brain to potential irreversible harm.

V. AREAS OF POLICY ACTIONS

V.1. Specific receptors and use cases

V.1.1. Children, Youths, Young adults

93. Member States should promote healthy brain development through policies that support prevention or early diagnosis of neurological and mental disorders, enhanced education and continuous learning alongside a commitment to the development of the child through a rich social life, relationships, and healthy lifestyle (e.g., in terms of nutrition and physical activity).

94. Member States should develop the design and implementation of public policies focused on reducing brain health inequalities resulting from neurotechnology in the population.

95. Member States should protect the autonomy of children through informed consent and assent that is adapted to and respectful of age and decision-making capacity. Given substantial differences between consenting a child and an adult for research or clinical procedure related to variable patterns and rates of neurodevelopment, it is advised that no predetermined minimum age of consent or refusal concerning medical treatments applies. A capacity-based framework wherein researchers first defer to the judgment of minors deemed capable through standardized metrics has been a recommended approach.

96. Member States should develop special protections that guard against the instrumentalisation of medically-vulnerable children in research through extra levels (time, iterations) of consent and assent (e.g., children in epilepsy monitoring units).

97. Member States should develop safeguards against exploitation of children from resource-limited settings for the development and testing of neurotechnology.

98. Member States should ensure the protection of assent and consent from social pressure, force or coercion to use neurotechnology. Such protections could include mandating the presence of independent advocates during the consent process, employing age-appropriate and culturally sensitive communication tools, and investing in ethical training for professionals involved and regular audits of consent practices to ensure they are age and context-appropriate.

99. Member States should prohibit the misuse of neurotechnology on children such as surveillance, unconsented monitoring, and forced uses that may enhance wellness.

100. Member States condemn the misuse of neuroscience for the consumer market, especially those targeted at adolescents, that exploit the dopamine reward system or seek to induce addiction and overconsumption. Marketing for such products should require disclosures on their effects on brain chemistry, and schools should implement educational programs teaching students about the neuroscience of addiction and how to critically assess neurotechnology products.

101. Member States should condemn discrimination based on intellectual differences or those related to atypicality and ensure that neurotechnology is not used to inform, justify, or reify such discrimination.

102. Member States should fund research and development grants focused on creating user-friendly assistive neurotechnology tailored for children with disabilities. These projects should involve end-users in the design process to ensure the technologies meet their specific needs. Educational programs should be developed to teach children and their caregivers how to effectively use and maintain these technologies, with support available in multiple languages and accessible formats.

V.1.2. Older and Elderly Persons

103. With an aging population, the health and economic opportunity for neurotechnology is vast, as are the potential benefits and risks. Member States are called upon, therefore, to promote healthy aging and support people with neurodegeneration and dementia through neurotechnology if possible based on solid scientific evidence and social acceptability.

104. Member States should fund and support programs that promote quality of life by integrating neurotechnology into routine care for the elderly. These programs should prioritize motor and cognitive stimulation tools to prevent or delay the onset of age-related disabilities. Additionally, neurotechnology should be integrated in a way that supports the ecosystem of older individuals, including family, caregivers, and medical teams, who are essential to their thriving. It is crucial to foster partnerships with academic and research institutions to ensure that these technologies remain at the cutting edge of care.

105. Member States should develop and promote international research collaborations focused on advancing curative neurotechnology like Deep Brain Stimulation (DBS), wearable exoskeletons, and cognitive aids. This should include standardizing protocols across borders to ensure data comparability and innovation.

106. Member States should implement policies that ensure access to neurotechnology for healthy aging is a priority and that such access does not exacerbate inequalities associated with socioeconomic background. This could include government-funded programs specifically designed to support neurotechnology access for low-income elderly populations, or subsidization of the cost of neurotechnology to ensure equitable access for all eligible older adults.

107. Member States should establish enforceable guidelines for neurotechnology design sensitive to the usability needs of older adults, carefully considering human-computer interface factors for usability (such as fonts, buttons, and colour) for enhanced visual and auditory cues.

108. Member States should ensure older people are included as co-creators of innovations in neurotechnology to ensure age-compatibility and usability by creating advisory panels consisting of older adults to co-develop and test new neurotechnology products. These panels should be included throughout the entire life-cycle of product development.

109. Member States should preserve, support and promote autonomous decision-making to the greatest extent possible and enable older people to use neurotechnology beneficially for sensorimotor and cognitive support. Policies should be in place to ensure that any form of assistive technology respects the user's preferences and consent. Such policies should verify that surrogate decision-makers are acting in the best interest of the affected person.

110. Member States should ensure that the consent process accommodates the cognitive challenges that might be faced by older adults, ensuring that consent is informed, ongoing, and adaptable to their changing health conditions. This includes providing the option for surrogate decision-making in alignment with the individual’s previously expressed wishes or best interests.

111. Member States should develop ethical guidelines to ensure that neurotechnology such as robotic caregivers enhance rather than replace human interaction, particularly in the care of individuals with neurodegeneration. These guidelines should emphasize the augmentation of human care, not its replacement.

112. Member States should enforce strict regulations against the use of neurotechnology to perpetuate stereotypes, stigma, or discrimination against older persons. Monitoring bodies

should regularly review neurotechnology applications to ensure they foster positive representations of aging.

113. Member States should develop age-appropriate, contextually-appropriate, culturally-appropriate, and linguistically-appropriate education about neurotechnology. This should include training modules for caregivers and family members to aid in the supportive use of these technologies at home.

V.1.3. Women and Gender

114. Member States should enforce policies promoting respect for gender diversity in neurotechnology research, development and innovation. Such policies should promote inclusion of women, girls, and individuals of diverse sexual orientations and gender identities in all stages of research, from conceptualization to clinical trials, ensuring that study designs reflect the needs and conditions specific to these groups.

115. Member States should ensure that safety for women and gender minorities is prioritized in the research, development, and implementation of neurotechnology.

116. Member States should establish clear guidelines and legal frameworks that safeguard against harassment and discrimination in the use, development and implementation of neurotechnology. This should include robust mechanisms for reporting and addressing incidents of harassment, ensuring accountability and support.

117. Member States should adopt funding policies that prioritize ethical and equitable research and innovation in neurotechnology. This could include grants and scholarships specifically targeted at projects that aim to correct historical biases and disparities, and the support of programs that foster women’s and gender minorities' participation in neurotechnology through education, employment, entrepreneurship, and leadership roles within the sector.

118. Member States should fund and support initiatives that promote educational, employment, entrepreneurial and other professional opportunities for women and gender minorities in neurotechnology. This could include mentorship programs, networking opportunities, and career development workshops tailored to empower women and gender minorities in the field.

V.1.4. People with Physical Disabilities

119. Worldwide, there are significant differences in the manner in which people with physical disabilities related to the nervous system are included in society, and their disabilities accommodated. This includes people with visual impairments such as blindness, deafness, spinal cord injuries and other movement disorders, and brain injuries. Visual aids (eyes glasses) and hearing aids are generally ubiquitous, but regional costs and access to them vary widely. Moreover, advanced technology for conditions that have a medical basis are far less available to underserved and under resourced populations. People with disabilities in these contexts are particularly disadvantaged. Given the significant disparities in how people with physical disabilities related to the nervous system are accommodated worldwide, Member States should adopt specific measures to ensure that neurotechnology is used equitably and inclusively.

120. Member States should establish regulatory frameworks that implement accessibility assessments for all new neurotechnology products to ensure new products do not perpetuate the consequences of existing disabilities or health disparities, include protocols for testing with diverse groups of disabled individuals to ensure technology meets a wide range of needs, and

does not unintentionally exclude or disadvantage any subgroup.

121. Member States should develop incentives for companies and research institutions to create neurotechnology specifically designed to improve the quality of life and functional independence of people with disabilities. This could include tax breaks, grants, or expedited regulatory reviews and approvals for technologies that offer significant advancements in mobility, communication, or daily living for disabled individuals.

122. Member States should improve access to advanced and timely advances in neurotechnology for all citizens that need them, with special attention paid to those with physical disabilities. This includes access to neuroprosthetics, advanced visual and hearing aids, and other assistive neurotechnology devices. Public-private partnerships could be encouraged to develop affordable versions of advanced neurotechnology.

V.1.5. People with Mental Health Disabilities

123. Member States should consider the increasing burden of mental health conditions, including people with anxiety, depression, post-traumatic stress disorders, eating disorders, addictions and victims and survivors of trauma and violence. This is a highly heterogeneous population; co-morbidities are the norm, not the exception. Given the novelty of neurotechnology used for mental health conditions, the uncertainty of their long-term efficacy, the unknown consequences of neuromodulation on long-term development, and the risk of psychological maladjustment, it is important to develop research and to ensure that people with mental health conditions are well-informed and have reasonable expectations about the process.

124. Member States should conduct impact assessments for all new neurotechnology, including an evaluation of their impact on existing mental health disparities and their consequences. Mental health advocacy groups and population-specific stakeholders should be included in the design of these impact assessments to understand the effects of neurotechnology on various mental health conditions.

125. Member States should prioritize funding of neurotechnology that is designed to improve quality of life and daily functioning for individuals with mental health conditions. This includes technologies that assist in managing symptoms, improving cognitive functions, and providing emotional support at home, in the workplace, in their communities, and in society. Research and development should be guided by feedback and engagement with mental health patients and their advocates.

126. Member States should establish policies that improve access to timely advances in neurotechnology to those with mental health conditions to ensure that cost is not a barrier to accessing potentially life-altering treatments and supports.

127. Member States should enforce strict guidelines on the use and storage of mental health data collected via neurotechnology. This should include mandatory encryption of data, limitations on data sharing without explicit patient consent, and severe penalties for unauthorized access or breaches.

128. Member States should implement guidelines that encourage prevention of overreliance on neurotechnology for managing mental health conditions. This includes establishing protocols for regular review of the effectiveness of neurotechnology interventions and ensuring that they are used as part of a broader, holistic evidence-based treatment plan.

V.2. Health

129. Member States should encourage the development of health applications prioritizing the unmet needs in neurological treatment and health in general.

130. Member States are encouraged to build and maintain international solidarity to address global health risks and uncertainties and ensure that their implementation of health care is consistent with international law and human rights obligations.

131. Member States should consider the significant cost and impact associated with brain health, as well as the potential benefits of preventive and assistive neurotechnology. Public policies should prioritize the promotion of access to these technologies and ensure health cost coverage for individuals in need.

132. Member States should pay particular attention to regulatory processes ensuring

a. that the professional, the patient, the caregivers and technology developers/operators/providers/scientists will be involved in the steps of neurotechnology development.

b. due attention to protecting the privacy of potential patients who are medically monitored and ensuring that all relevant and international data protection requirements are met, especially for health-related sensitive data.

133. Member States should ensure that informed consent procedures for neurotechnology are comprehensive and transparent, providing detailed information about the purposes, risks, benefits, alternatives, and possible outcomes of the technology. These procedures must emphasize that consent is entirely voluntary and ensure individuals fully understand the implications for their privacy, autonomy, and well-being. Additionally, individuals must have the clear right to refuse or withdraw from neurotechnology treatment at any time, ensuring their autonomy and respect for their decision-making capacity is upheld.

134. Member States should encourage sustainable and responsible use of neurotechnology. It is imperative to address durability that will ensure that neurotechnology devices withstand the rigors of everyday use, maintaining their functionality and efficacy over time. These considerations underscore the need for oversight by regulatory bodies or designated entities to uphold standards of quality, safety, and longevity in the deployment of neurotechnological solutions.

135. Member States are encouraged to establish practices and policies to monitor adverse effects of neurotechnology used for health purposes (neurotechnology vigilance).

136. Member States should establish oversight mechanisms to evaluate the physical impacts of long-term use of neurotechnological devices. This includes regulatory measures to ensure that such experiences promote brain health and do not cause long-term negative consequences.

V.3. Research Ethics

137. Member States should encourage research on neurotechnology by proper funding and removal of obstacles to research.

138. Member States are urged to work on equity of research in this field, in view of unequal research production on neurotechnology, among countries (in 2024, 6 countries account for 87% of neurotechnology patents produced worldwide). More cooperation can be achieved through encouraging multicentre international research that involves various cultures and

ethnic groups.

139. Member States should ensure that research fulfils ethical and human rights recommendations that target human well-being and minimizes risks to nervous system integrity.

140. Member States should ensure rigorous benefit-risk assessments in all neurotechnology research involving patients, as standard practice. These assessments must be thoroughly documented, justifying the rationale for the research based on the anticipated benefits outweighing the potential risks. Ethical oversight bodies should review these assessments to maintain high standards of patient safety and well-being. Moreover, ongoing monitoring should be employed to adjust protocols in response to emerging data throughout the research process.

141. Member States should ensure research involves strict oversight and close follow-up of all neurotechnology research involving children and adolescents. This oversight is crucial during the developmental phases of childhood to address and mitigate any unforeseen long-term effects. Such research must include comprehensive monitoring protocols and periodic evaluations to ensure the ongoing safety and well-being of young participants, taking into account their unique developmental needs and vulnerabilities.

142. Member States should adopt and enforce a global standard to ensure special protection for vulnerable groups during neurotechnology research that modulates brain functions. This standard should mandate enhanced ethical oversight, culturally and cognitively appropriate informed consent processes, and continuous monitoring to safeguard the interests and well-being of these populations throughout the research.

143. Member States should adopt clear guidelines or policies that define:

a. What are the **qualifications of those who are eligible to perform neurotechnology research** with humans for research on collecting neural and cognitive biometric data, for therapeutic purposes, or augmentation of function in healthy persons?

b. **Who:** neuroscientists and professionals with appropriate knowledge about the nervous system and brain connections, functional anatomy, neurochemistry and neurophysiology, in addition to brain disorders.

c. **Where:** research is to be performed in centres of excellence such as universities and research centres that have qualified personnel (as mentioned above)

d. **Who can be included in research or in application of neurotechnology?** Adult individuals who have free will and mental capacity to consent for these procedures whether for research purposes, therapeutic indications or functional augmentation.

e. **Who should deserve special attention** and careful evaluation of the protocols by registered ethics boards (IRBs or ethics committees): individuals with special situations regarding vulnerability such as diminished capacity to consent or to make decisions (eg. children with autism, cerebral palsy, mental or motor retardation, or people with alteration of consciousness, etc.). The consent process should be obtained from legally identified surrogates such as parents or legal guardians.

f. Which **type of research** or applications could be **prioritized**? Research with sound rationale for improvement of function or amelioration of disease pathology or symptoms; research with benefits outweighing risks.

g. Which **type of research** should be discouraged? Research with outcomes or purposes at odds with human rights and human flourishing, such as intentional disablement or

disorientation of human capacities.

h. What constitutes clearly informed consent? Consent to be enrolled in research should include all side effects, and a clear statement by the participant that he/she has no contraindications for the procedures used.

i. **What are the data collection policies?** Any authorized data collection through research should receive consent of participants under research stating clearly that the data can be used for further research.

144. Member States should reinforce the ethical frameworks governing neurotechnology research to ensure robust protection for both human participants and animals.

145. Member States should ensure all research institutions have mandatory ethics training for researchers, including those involved in animal studies. Institutions should build capacity for ongoing research oversight to maintain high ethical standards.

146. Member States should ensure those engaged in research implement regular auditing and monitoring of research practices to ensure adherence to ethical standards. This should include evaluating the adequacy of informed consent, particularly concerning data reuse and the potential commercialization of neural data.

147. Member States should ensure their animal welfare laws align with the latest ethical standards in research and industrial use. They should support the development of tools that can assess distress and pain in experimental animals to minimize suffering. And should encourage that researchers adopt the 3R principles (replace, reduce, refine) in all animal research, with an emphasis on developing and following common standards for implantable devices that facilitate data reuse and reduce the number of animals used.

148. Member States should promote international cooperation to develop common reporting standards and protocols, particularly for implantable neurotechnology devices. This cooperation should aim to enhance the comparability and utility of research data globally, improving both the efficacy and ethical integrity of research.

V.3.1. Clinical trials

149. Member States should develop a regulatory framework for individual instances (including academia, universities, medical centres and institutions, as well as industry) that establishes a procedure for clinical trials to follow mechanisms to identify, prevent, mitigate and account for how they address the respect of the pursuit of beneficial effects and human rights. This includes mechanisms to protect from potential harms and an adequate harm/benefit balance. Additional mechanisms should be provided to protect the self-determination and dignity of persons/patients as well as due diligence and oversight mechanisms to address problems.

150. Member States should evaluate and update their existing regulations for the approval of the use of neurotechnology for medical purposes as part of an evidence-based system.

151. Member States must provide an enabling environment for public and private developers to engage with the biomedical community (hospitals, clinics, medical institutes etc.) to properly develop methodologically sound clinical trials protocols that serve as a paradigm for the evaluation of neurotechnological developments.

152. Clinical trials should be understood as properly designed interventions with adequately selected human groups in a comparative fashion with other modes of dealing with the specific problem under study. Ethical impact assessments should be transparent and open to the public

when appropriate. Assessments should be multidisciplinary, multi-stakeholder, multicultural, pluralistic and inclusive. Assessment and intervention should identify impacts on human rights.

153. Member States should ensure that the entire life cycle of neurotechnology is considered in the design of a clinical trial, including policies to protect patients in case of cessation of activities of the promoter.

154. Member States should establish requirements for clinical trials to participate in appropriate WHO approved registries. Also, clinical trials should report on appropriate technovigilance systems developed within Member States.

155. Validation of AI algorithms in neurotechnology research should include rigorous testing for biases, as well as measures to enhance explainability and transparency. Debiasing techniques should be employed to mitigate any biases present in AI models used in neurotechnology applications.

156. Privacy assessments, particularly focusing on mental privacy, should be conducted through Privacy Impact Assessments (PIAs) or similar assessment tools. These assessments should evaluate the potential risks to individuals' mental privacy posed by neurotechnology research and implementation, ensuring that appropriate safeguards are in place to protect neural and cognitive biometric data.

157. Research efforts should not only focus on biomedical risks associated with neurotechnology but also investigate potential effects on an individual's subjective experience and personal identity. Understanding how neurotechnology may impact aspects of self-perception, consciousness, and identity is essential for addressing ethical concerns and ensuring the well-being of individuals using these technologies.

V.4. Neural and Cognitive Biometric Data Policy (medical, sensitive, personal, health, broadly)

158. Neural and cognitive biometric data are uniquely sensitive because they provide deep insights into the pre-behavioural processes that underpin our mental states and cognitive functions. These data types go beyond traditional biometrics by revealing not only the structure and function of the nervous system but also intricate details about an individual’s thoughts, intentions, and underlying mental states. The complexity and sensitivity arise from their ability to capture metacognitive aspects such as self-awareness and introspection, along with their high data density which can inadvertently expose detailed personal information even when collected for unrelated purposes. This makes them critical to protect under data privacy and security frameworks.

159. In response to the rapid evolution of neurotechnology and its profound implications for mental privacy and self-determination, there is an urgent need for Member States to develop a robust framework to govern the collection, processing, and use of neural data. Recognizing the diversity of legal, technological, and cultural landscapes across the Member States, these policies aim to balance the promotion of technological innovation with the imperative to protect mental privacy, freedom of thought and self-determination, ensuring that neural and cognitive biometric data are managed in a manner that is ethical, sustainable, and aligned with global human rights standards.

160. Member States should strengthen consumer protection laws to safeguard individual and community rights to autonomy and cognitive liberty, and include specific provisions for the collection, processing, use and storage of neural and cognitive biometric data. These laws should ensure that individuals have a right to access these data, and a right to use commercial

services without compulsory disclosure of these data, except where required for service functionality. Importantly, the right to access neural data should incorporate a right to receive information that is accessible and comprehensible to the individual.

161. Member States should evaluate current laws to ensure robust protection of neural and cognitive biometric data, including specific guidelines to protect vulnerable populations such as children, the elderly, or those with neurological impairments. Where gaps exist, implement regulatory approaches that consolidate and enhance data and privacy protections with a unified legal framework that addresses both neural data and cognitive biometric data.

a. Current data protection frameworks at regional levels, which mandate explicit consent for processing sensitive data, should be updated to explicitly recognize neural and cognitive biometric data, especially when not classified directly under health data. Similarly, these frameworks could be extended to cover neural and cognitive biometric data collected outside traditional healthcare settings. Jurisdictions with biometric information privacy laws should ensure protections are sufficiently robust to cover the unique aspects of neural and cognitive biometric data beyond its use for identification to address inferences drawn from that data, enforcing stringent consent requirements and safeguarding against unauthorized use.

162. Member States should adopt regulatory frameworks that emphasize data minimization and purpose limitation, collecting and processing neural data only as necessary for clearly defined purposes and storing it only as long as needed for those purposes. This should include mechanisms for individuals to request the deletion or anonymization of their neural and biometric cognitive data when it is no longer necessary for the purpose for which it was collected or when consent is withdrawn. These policies should reduce the ecological footprint associated with large-scale data centres and computing resources, supporting global efforts towards environmental sustainability, while protecting mental privacy.

163. In response to rapid advancements in neurotechnology and their convergence with other technologies including AI, spatial computing and immersive technologies, Member States should adopt agile regulatory frameworks and regulatory sandboxes. These frameworks should facilitate innovation, ensure ethical data processing, and include mechanisms to regularly monitor, evaluate, and dynamically adjust neural data policies based on technological advancements and ethical developments.

164. Member States should support the development and implementation of technological innovations and design standards for neurotechnology that prioritize mental privacy, such as state-of-the-art encryption, secure databases with multi-factor authentication, cutting-edge anonymization techniques, and edge-processing and storage (processing and storing data closer to where it’s being generated), leading to greater action-led results in real time and storage of neural data.

165. Member States should encourage ethical data sharing by establishing secure, data repositories for neural and cognitive biometric data used in research. These repositories should meet stringent cybersecurity, data privacy, and ethical use standards (including data minimization and purpose limitations), tiered access and other privacy-enhancing approaches. Developing and supporting global interoperability standards for neural and biometric cognitive data may likewise enhance cross-border research and cooperation.

166. Member States should consider specific guidelines for the ethical use of neural and cognitive biometric data in AI development and research, including consent procedures for uses of neural data in training AI models, ensuring transparency and respecting individual and

community rights.

167. Member States should incentivize neurotechnology manufacturers to prioritize privacy and ethics by design, requiring the incorporation of privacy-preserving technologies as default features in their devices. This proactive approach ensures that privacy protections are embedded into the design and functionality of neurotechnological devices from the outset, enhancing user privacy and data security. Manufacturers should implement state-of-the-art encryption, secure authentication mechanisms, and anonymization techniques to safeguard neural and cognitive biometric data and protect users' mental privacy.

V.5. Enhancement/Augmentation

168. Member States should adopt a carefully balanced approach to using neurotechnology that directly changes the structure or activity of the nervous system and creates new kinds of disparities in the global world. Enhancing neurotechnology are here defined as those that are designed to promote brain and mental wellness outside of any medical context. Neurotechnology enhancement should not exacerbate social inequalities or lead to discrimination against individuals based on their enhanced or non-enhanced status. Member States should protect individual and community rights while supporting innovation and the responsible use of enhancement technologies. The use of neurotechnology for enhancement and augmentation introduces complex ethical, social, and legal challenges. These technologies, while offering significant potential to enhance human flourishing, raise crucial questions about equity, consent, individual and community autonomy, and the nature of enhancement itself. Regulatory frameworks should be adaptable to accommodate new insights and technological evolutions without stifling innovation.

169. Member States should support research and development of neurotechnology that contributes to enhanced wellness, that improves life quality without compromising the individual’s mental and physical health. This includes developing definitions and guidelines that define the use of neurotechnology for “enhancement” as the use of neurotechnology to promote brain and mental wellness.

170. Member States should ensure that the principles of autonomy, self-determination, should be paramount in the governance of neurotechnological enhancements. This includes consideration of the relational aspects of autonomy, acknowledging that individual decisions may affect communities and societal norms. Individuals and communities should have the right to decide whether to use such technologies without coercion. Policies should support fully informed consent, ensuring individuals fully aware of the potential limitations, benefits, and risks.

171. Member States should adopt policies to ensure that neurotechnology enhancements do not exacerbate social inequalities or lead to discrimination against individuals based on their enhanced or unenhanced status. This includes policies and investments that support equitable access to enhancement technologies, to prevent a divide between those who can afford enhancements and those who cannot.

172. Member States should encourage and incentivize “sandboxing” for safety testing neurotechnology under controlled conditions. This approach facilitates innovation while still safeguarding public health and safety by monitoring and evaluating the technologies before they are widely deployed. Safety and efficacy standards should be based on rigorous scientific testing and ethical analysis, particularly for technologies like brain stimulation and transcranial magnetic stimulation, which pose unknown long-term risks.

V.6. Communication and Information

173. Effective communication and comprehensive stakeholder engagement (including community engagement) are essential in the development, deployment, and governance of neurotechnology. There is a growing need for effective public education, engagement in technology and policy co-creation, and the responsible communication of neurotechnology-related information. Transparency, public literacy, empowerment, and inclusiveness are crucial to ensure that neurotechnology is developed and used ethically and beneficially. Member States should invest in communication and engagement policies for neurotechnology that foster informed, inclusive, and respectful dialogue between developers, users, and the broader public to respect individual and community rights, promote public trust, and harness the collective intelligence and diversity of communities.

174. Member States should collaborate with international organizations, educational institutions, and private and non-governmental entities to develop comprehensive educational programs about neurotechnology. These programs should aim to increase public understanding of the technologies' functionality, safety, efficacy, and societal impact, thus empowering individuals with the knowledge to make informed decisions about their use. Empowering individual decision-making will require educational investments in fostering self-determination, including the development of effective introspection, mental agility (critical thinking and discernment skills), and relational intelligence (relationship to self, others, and technology).

175. Member States should collaborate with international organizations, educational institutions, and private and non-governmental entities to develop and disseminate accessible and engaging educational materials tailored to diverse audiences to bridge knowledge gaps, particularly in underserved regions.

176. Member States should implement multi-stakeholder engagement processes that include diverse community representatives, ethicists, neurotechnology users, developers, researchers, and other relevant and impacted parties. These processes should facilitate genuine mutual learning and collaboration in neurotechnology development.

177. Governments should commit to engaging the public in the decision-making processes concerning neurotechnology. This includes conducting regular and inclusive consultations with a wide array of stakeholders—patients, researchers, healthcare providers, neurotechnology users, ethicists, community leaders, and the general public—to listen to and include diverse perspectives and concerns. These consultations should aim to inform policy development, increase public awareness and understanding of neurotechnology, align investment priorities in neurotechnology, and ensure that the deployment of these technologies aligns with the public’s interests and values. Special attention should be given to involving groups that are traditionally underrepresented in technological policymaking.

178. Member States should develop regulatory frameworks and policies that require clear, accurate, and ethical communication standards for neurotechnology, grounded in data and evidence to prevent sensationalism or misinformation and promote understanding of the benefits, risks, and limitations of neurotechnology. This includes establishing guidelines for the ethical marketing of neurotechnology, which should clearly label potential risks and define realistic and evidence-based benefits, and guidelines concerning early-stage clinical trials and emerging technologies, to avoid public misperceptions, unrealistic expectations and hype about neurotechnology.

179. Manufacturers, developers, and researchers are encouraged to communicate

responsibly concerning neurotechnology to prevent sensationalism, particularly in the portrayal of capabilities such as “mind-reading” or “telepathy.” They should collaborate in the co-creation of accurate, precise, and accessible language and terminology for discussing neurotechnology that involves stakeholders from diverse backgrounds to ensure that the language used is inclusive, non-stigmatizing, and accurately reflects the technologies' capabilities and limitations. Additionally, they should develop common standards for reporting complications, failures, feedback, and successes.

180. Stakeholders must rely on accurate data about the legitimate capabilities and performance limitations of neurotechnology, including but not limited to applications in sleep, attention, memory, and emotional regulation.

181. Member States should develop policies that encourage effective co-operation between end-users and innovators to optimise device efficacy, usability, longevity, and sustainability. Member States should facilitate platforms for ongoing dialogue and feedback.

182. Communications regarding neurotechnology should acknowledge and protect the right of individuals to opt-out of using neurotechnology and participating in digital networks. Policies should respect individual choices and provide alternatives for engaging with society and accessing services without compulsory digital or neurotechnological integration.

V.7. Educational settings

183. The integration of neurotechnology into educational settings offers significant potential to enhance learning and personal development. These technologies can benefit sensory, motor, and mental states, support personalized learning, and foster greater attention and engagement. To ensure benefits in learning environments from these advancements, it is essential to maintain strong commitments to individual and collective autonomy, mental privacy, and equitable access. This includes avoiding coercive use of neurotechnology or discrimination based on the choice to use or not use them.

184. Member States should support the development of beneficial uses of neurotechnology that, grounded in data and evidence, improve educational outcomes through personalised and adaptive learning environments without compromising the mental health or well-being of individuals.

185. Member States should adopt policies that prevent the coercive use of neurotechnology in educational settings. These policies should ensure that the deployment of these technologies is voluntary, with fully informed consent and/or assent obtained from both individuals, and in the case of children, parents or guardians, and establish the right to opt-out without any repercussions to the individual’s educational opportunities.

186. Member States should foster environments where students and learners are actively involved in decisions about how neurotechnology is integrated into their education, and include training on ethical usage of neurotechnology and empower students with the capabilities to critically assess, learn about the benefits and risks, and make informed decisions about their use.

187. Member States should encourage educational strategies that foster self-determination of individuals across society to empower them in their decision-making about neurotechnology, by cultivating skills of introspection, critical thinking, mental agility, and relational intelligence (relationship to self, others, and technology).

188. Member States should establish robust monitoring frameworks to oversee the use of neurotechnology in educational settings. This should include regular audits, stakeholder

feedback, and adherence to safety and ethical standards to ensure the technology is used appropriately and effectively.

189. Member States should regulate the use of neurotechnology in the educational setting to ensure that it is suitable for the age and cognitive development of children or students.

190. Member States should prioritize the holistic development of children, focusing on their overall interests and well-being rather than merely enhancing academic performance through neurotechnology. Educational tools should support diverse learning styles and foster critical thinking, creativity, and emotional intelligence.

191. Member States should implement policies that ensure the use of neurotechnology in examinations and academic advancement is fair and equitable. This includes establishing guidelines to prevent any technology-induced disparities among students and ensuring that all students have equal opportunities to benefit from educational advancements.

192. Member States should implement measures to ensure equitable access to neurotechnological tools across different socioeconomic groups within educational systems. This should address potential disparities in access to these technologies to prevent the creation of a divide between students who can afford these technologies and those who cannot.

193. Member States should establish a unified oversight mechanism to monitor the use of neurotechnology in educational settings and fund continuous research to assess its long-term psychological and cognitive impacts. This approach will ensure the technology is safe, effective, and adjusted based on empirical evidence to best serve student development while addressing potential risks like dependency or de-skilling.

194. Member States should develop policies that ensure transparency in how neurotechnology is used within educational settings and protect students against any form of profiling that could lead to discrimination. Regulations should clearly define the purposes for which neurotechnology is employed and strictly limit the collection and use of neural data to educational purposes agreed upon by stakeholders.

195. Member States should invest in educational and professional development programs that equip innovators and business leaders with the skills to integrate ethical considerations into the lifecycle of neurotechnology products. This should include training in ethical design, human rights law, and societal impact assessment to prepare the next generation of technologists to think critically about the implications of their work.

V.8. Labour

196. As neurotechnology evolves and converges with other technologies in the workplace, they present unique opportunities and risks in labour settings. Member States should develop policy frameworks that protect employees' mental privacy and the right to self-determination but also promote their general wellness and mental wellbeing. These recommendations aim to balance the potential for human flourishing with the imperative to safeguard against practices that could infringe on mental privacy and dignity.

197. Member States should establish workplace policies and incentives that ensure neurotechnology is used on a voluntary basis and for applications that align with human flourishing, such as providing employees with access to neurotechnology that promotes well-being (e.g. stress reduction through guided meditation), improve workplace conditions (e.g. adaptive and responsive workplaces that calibrate workload in response to cognitive load). Employees should be able to opt-out of use of neurotechnology without consequence and risk of discrimination. In no instance should these technologies be used for punitive measures or

mental surveillance.

198. Member States should require employers to clearly provide employees with comprehensive information about how neurotechnology used in their workplace works, the benefits it offers, transparency about what data is collected, how it is used, and who has access to it, and clearly disclose any potential risks of their use.

199. Member States should require employers who use neurotechnology in the workplace to adopt transparent policies that disclose the purpose of the use, limit the scope of its use to legitimate purposes (e.g. monitoring fatigue in commercial drivers or tracking attention in air traffic controllers). To respect employees' mental privacy, employers should be prohibited from unauthorized access to neural and cognitive biometric data that may be collected incidentally during legal workplace monitoring. Employers should be prohibited from using neural and cognitive biometric data for any non-consented purposes, particularly those that could negatively impact an employee's job security or privacy.

200. Member States should require employers to adopt best practices for data minimization and secure storage of neural and cognitive biometric data. Ensure that data is stored securely, with access limited to authorized personnel only, and is deleted or anonymized once its intended purpose has been fulfilled.

201. Member States should ensure that when employees are issued multifunctional devices (e.g. earbuds, or headphones that also include neural sensors) that can be used at work or at home, employers should be prohibited from collecting neural and cognitive biometric data outside of workplace settings and working hours and ensure that any data collected during work is used exclusively for agreed-upon purposes. Employers should implement technological safeguards to automatically disable data collection during non-work hours.

202. To enable innovation in workplace use of neurotechnology, Member States should encourage the use of "sandboxes" to explore innovative applications of neurotechnology in the workplace under ethical oversight. These sandboxes should facilitate experimentation while safeguarding employee rights, with regular assessments to ensure compliance with ethical standards.

203. Employees must have a right to obtain a copy of any neural and cognitive biometric data collected about them, along with any interpretations drawn from it in an accessible and comprehensible manner. To use these tools without consent constitutes a breach of trust, undermining the value they would otherwise create. Giving employees the right to access their own brain data can help build trust and ensure that only relevant and necessary neural and cognitive biometric data is collected. It also provides a check on the quality of the data being collected and an opportunity for employees to challenge invalid interpretations.

204. Member States should ensure that if neurostimulation is used in the workplace it is used only with explicit employee consent, for purposes that demonstrably enhance workplace safety, employee well-being and dignity, and not for enhancing productivity at the expense of employee health.

205. Develop stringent regulations against "neuroprofiling" in the workplace, including in hiring. These regulations should prohibit the use of neural and cognitive biometric data to discriminate against candidates, particularly neuro-atypical individuals, ensuring hiring practices are fair and inclusive.

V.9. Direct to Consumer Commercial Products

206. The expansion of neurotechnology into recreational and commercial domains brings

both opportunities and ethical and human rights challenges. It is crucial that Member States proactively establish a regulatory framework that promotes innovation while protecting individual rights and promoting societal well-being. This framework should be dynamic, allowing for timely updates as technology evolves and new insights are gained about its impacts on society.

207. Member States should proactively establish a dynamic regulatory framework that promotes innovation in the recreational and commercial use of neurotechnology while protecting individual rights to self-determination and promoting societal well-being. This includes providing adequate oversight to ensure that neurotechnology does not cause harm, are used consensually, and include robust mechanisms to protect users from potential psychological distress or manipulation. The framework should be flexible, allowing for timely updates as technology evolves and new insights are gained about its impacts on society.

208. Member States should strengthen comprehensive consumer protection laws to include clear labelling on commercial neurotechnology products, detailing their effects, limitations, and risks to prevent misleading claims and ensure transparency. This also includes prohibiting practices of “tying” or requiring the disclosure of neural and cognitive biometric data as a condition to access goods or services.

209. Member States should foster an environment that ensures that all claims about these technologies should be supported by scientific evidence, claims that address medical conditions must additionally be validated through rigorous clinical trials and used under medical supervision. This ensures the technologies are not only innovative but also safe, effective, and truly beneficial for users.

210. Member States must enforce informed consent processes that are thorough and transparent across all neurotechnological interventions, ensuring that participation is fully voluntary and respects the privacy and autonomy of individuals. This principle should apply uniformly in various domains such as sports, arts, and 'neurohacking,' where robust standards should safeguard against coercive use and respect athletes’ and artists’ individual autonomy, community interests, and intellectual property rights.

211. Member States should support the development of neurotechnology applications in the arts that enhance learning and cultural appreciation without compromising individual autonomy or cultural homogenization. This includes fostering the responsible integration of neurotechnology in the arts, ensuring that they enhance creativity without infringing on artistic freedom or intellectual property rights. Transparency and ethical practices that respect artists’ and audiences’ rights and well-being, the diversity of cultural perspectives and the integrity of educational content.

212. Member States should ensure that neurotechnology used in recommendation systems respect users’ rights to mental privacy and both personal and collective autonomy in their choices. Regulations must prevent the misuse of neural and cognitive biometric data for manipulative marketing practices and ensure that users have clear, straightforward ways to opt-out of data collection and profiling.

213. Member States should ensure that devices capable of multiple functions, such as XR glasses or smart earbuds with neural sensors, include hardware-based controls that allow users to selectively disable neurotechnology features while maintaining basic functionality. Regulations should ensure that 'opt-out' features are accessible and straightforward, promoting healthy, balanced use especially among children and vulnerable populations.

214. Member States should support comprehensive research on the long-term effects of commercial applications of neurotechnology. They should also evaluate their existing regulatory oversight mechanisms to ensure that they are adequate to assess the alignment between (neuro)scientific research supporting brain wellness products and the marketing claims associated with these technologies.

V.10. Ethical Considerations and Risks of Commercial Nudging, Cognitive Shaping, Manipulation

215. As neurotechnology advances, their integration into commercial applications such as marketing and consumer behaviour modification presents unique ethical challenges. This policy area addresses four critical concerns: priming and nudging, dream marketing, neuromarketing, and closed-loop environments. These technologies, while promising significant advancements, also raise profound ethical questions regarding autonomy, consent, privacy, and the potential for manipulation.

216. Member States should adopt a regulatory framework that sets out a procedure, particularly for public authorities, to predict consequences, mitigate risks, and address the risks and benefits from cognitive shaping and nudging of individuals.

217. Member States should adopt regulatory frameworks and oversight mechanisms to ensure that neural and cognitive biometric data used for nudging or priming human behaviour are used in a transparent way and that their use does not undermine self-determination/autonomy. These frameworks should require transparent disclosure about the use of such methods and enforce the principle of voluntary participation with explicit informed consent.

218. Member States should develop oversight mechanisms to prevent the use of neurotechnology to drive compulsive or addictive use, particularly if they target neural reward circuits to alter consumption behaviours. Such regulations should mandate clear labeling of risks, enforce game design standards that discourage compulsive use of gaming or digital recreational platforms combined with neurotechnology, to promote healthy, balanced use, especially among children and vulnerable populations.

219. Member States should adopt specific guidelines prohibiting the use of neurotechnology and neural and cognitive biometric data for marketing during sleep phases to protect the self-determination of individuals, unless explicitly consented and opted into by the individual. As sleep is both a vulnerable state where individuals cannot consciously process external stimuli, and is a critical time for cognitive processing and memory consolidation, it should remain a private sphere free from external influence.

220. Member States should develop guidelines for neuromarketing practices to safeguard against unethical use. These guidelines should require comprehensive disclosures to ensure that all neuromarketing activities are conducted transparently, with participants' conscious, informed consent. This includes ensuring that participants in neuromarketing research or campaigns are fully aware of methods and intentions and affirmatively opt-in to participation. Use, storage and potential reuse of the collected data should be strictly regulated.

221. Member States should establish thorough policies to regulate the creation and utilization of closed-loop environments, such as immersive computing devices that adjust the immersive experience based on detected neural and cognitive biometric data. These policies must prioritize human rights and dignity, prevent potential abuses like behavioural modification, and guarantee that environments are designed to promote freedom of thought and self-determination.

222. Member States should require companies to disclose when AI algorithms, based on neural and cognitive biometric data, are used in making decisions that affect consumers, such as personalized advertising and content recommendations. Transparency should also extend to the algorithms themselves, potentially through mechanisms like algorithmic audits.

223. Member States should prioritize the establishment of clear, accessible, and ongoing informed consent processes for the use of neurotechnology. This ensures that all individuals, regardless of their technical expertise, can make well-informed decisions about engaging with neurotechnology. Consent should be viewed as an ongoing process, allowing users to reassess their choices as technologies evolve and as they gain more understanding of their implications.

V.11. Intellectual property

224. Member States should ensure stakeholders adopt IP management strategies that encourage innovation and avoid overly restrictive patent use, fostering an open innovation ecosystem. This approach should learn from the past of sectors like genomics and continuously adapt to the evolving landscape of neurotechnology. The impact of IP policies on the neurotechnology sector should be continuously monitored to ensure they stimulate innovation while ensuring ethical use and broad accessibility, and adjusted to address emerging challenges.

225. Member States should adopt policies that ensure that neural and cognitive biometric data, as individual human activity derivatives, are not subject to proprietary rights. IP protection should only apply to original data compilations (created through a process of aggregation, organization, or selection, resulting in a new dataset) that meet strict, clearly defined criteria emphasizing ethical considerations.

226. Member States should foster an environment of co-creation in neurotechnology, facilitating co-ownership and preferential licensing agreements to ensure equitable compensation and recognition for all contributors, particularly those from academic and research communities.

227. Member States should take a balanced approach between protecting intellectual property and promoting immediate publication of results and data sharing. Particularly with the convergence of digital technologies and the increasing concentration of those innovations in industry sectors, this balance is crucial to ensure that IP protection mechanisms do not hinder scientific research, innovation, and the wide dissemination of knowledge and new technologies.

228. Member States should collaboratively establish clear, harmonized guidelines for IP rights applicable to neurotechnology on an international scale. These guidelines should address the patentability of AI-generated inventions and the ethical implications of IP laws, ensuring they promote global accessibility and innovation.

V.12. Government Investment and Use

229. Member States and relevant international institutions should actively support the research, development, and deployment of neurotechnology for the public good . Investments should prioritize applications that foster human flourishing and respect individual and collective human rights. This commitment should include funding for interdisciplinary research that not only advances neurotechnological innovation but also studies the ethical, legal, and social implications of these technologies to ensure they benefit all sections of society equitably.

230. Member States should establish clear prohibitions against the use of neurotechnology in contexts that violate individual and collective human rights. Specifically, neurotechnology should not be used for purposes such as non-consensual interrogation in law enforcement,

development or deployment of neuroweapons, attempts at “moral enhancement” without consent, coercive “rehabilitation” based on personal beliefs or thoughts, or surveillance of mental states. Governments must enact legislation that ensures neurotechnology is deployed responsibly, with robust oversight mechanisms to enforce adherence to these restrictions and protect mental privacy and freedom of thought for all individuals. These policies should be developed in consultation with diverse stakeholders, including civil society, neurotechnology experts, ethicists, and human rights advocates, to ensure broad consensus and respect for global human rights norms.

231. Member States should ensure transparency and accountability in their use and regulation of neurotechnology. This includes public disclosure of all government-sponsored neurotechnology projects, their objectives, methodologies, intended uses, and impacts.

232. Member States should ensure that any use of neurotechnology in the judicial context is grounded in robust scientific evidence, implemented ethically and in accordance with human rights, and aimed at promoting public safety while protecting the rights and dignity of those involved. Any use of neurotechnology techniques within the judicial system must adhere to international human rights standards, ensuring respect for fundamental rights such as human dignity, bodily integrity, confidentiality of personal data, and the right to a fair trial. It is imperative that the use of such techniques is based on informed consent from the individuals concerned, with a clear understanding of the objectives, risks, and benefits of the intervention.

V.13. Economy & Investment/Incentives (Aligning economic incentives with human flourishing)

233. Member States should establish comprehensive incentive structures, such as tax incentives, grants, and awards, to encourage public and private sector commitments and partnerships in ethical neurotechnology development. These incentives should be focused on rewarding transparency, participatory development processes, and contributions to societal benefits, aiming to foster an environment where companies innovate responsibly and align with human flourishing goals. Such collaborations should aim to accelerate innovations in neurotechnology for the public good.

234. Member States should incentivise and support partnerships that leverage the computational resources and data analytics capabilities of private firms to advance public research goals. AI compute and manufacturing resources are often concentrated in large private corporations and necessary to advancement in neurotechnology research and development. This could involve negotiating agreements with major tech companies to provide computational power and manufacturing resources as part of their corporate social responsibility programs or creating government-funded platforms that offer these resources to researchers working on public health challenges.

235. Member States should encourage knowledge exchange between public research entities and private companies through workshops, joint research initiatives, temporary personnel exchanges, and sharing of AI compute and manufacturing resources and capabilities. These activities should aim to bring together researchers, clinicians, and industry experts to share insights and best practices in the development and application of neurotechnology.

236. Member States should adopt robust ethical frameworks that govern public/private partnerships, ensuring that all collaborative projects adhere to strict ethical standards, particularly regarding data privacy, individual consent, and the equitable distribution of any developed technologies. These frameworks should promote equity in the development and

distribution of neurotechnology. This includes supporting initiatives in underserved areas and ensuring that small and medium enterprises (SMEs) have access to funding, AI compute and manufacturing resources as well as markets. Efforts should be made to ensure that neurotechnology reaches all sections of the population, particularly those who might benefit the most from such technologies, thereby reducing health disparities.

237. Member States should develop guidelines and frameworks that encourage investors to consider ethical dimensions in their investment decisions in neurotechnology. This includes evaluating potential neurotechnology investments for their social and ethical impacts, not just economic returns. By encouraging transparency in investment processes, States can promote the idea of “ethical investment” as a valuable and distinctive approach within the financial community. Adopting a recognition system that publicly acknowledges and rewards organizations and researchers who excel in ethical neurotechnology development, certification programs, public endorsements, or inclusion in a globally recognized registry of ethical technology providers, could enhance their reputation and market access.

238. Member States should conduct comprehensive economic impact assessments of neurotechnology development and deployment. These assessments should explore how neurotechnology can drive economic growth, create new job opportunities, and potentially disrupt existing industries. Policies should be developed to leverage these economic benefits while mitigating negative impacts such as job displacement.

239. Member States should promote equitable access to neurotechnology worldwide. To achieve such goals, efforts should be made to reduce hardware costs, pursue the development and adoption of non-proprietary software solutions, and explore reimbursement plans by governments in sectors of crucial potential benefits such as health or education. Lowering the cost of hardware components essential for neurotechnology devices can make them more accessible to individuals and healthcare systems in low- and middle-income countries (LMICs) and resource-constrained settings. Additionally, prioritizing the use of open-source and non-proprietary software can facilitate collaboration, innovation, and interoperability among different neurotechnology platforms, ultimately benefiting users and researchers globally. These initiatives can help bridge the accessibility gap and ensure that the benefits of neurotechnology are available to all, regardless of socioeconomic status or geographical location.

V.14. Safety and Cybersecurity

240. Member States should collaborate to establish comprehensive standards for cybersecurity across all neurotechnology devices. These standards should encompass hardware, software, and data security measures to protect against potential cyber threats, such as unauthorized access, data breaches, and malicious attacks. By implementing uniform cybersecurity standards, Member States can ensure the integrity, confidentiality, and availability of neural data, as well as enhance user trust and confidence in neurotechnology devices. Additionally, these standards should evolve in tandem with technological advancements and emerging cyber threats to maintain robust protection against evolving risks.

241. Member States should employ red-teaming exercises as a proactive measure to assess and enhance the cybersecurity resilience of neurotechnology systems. Red-teaming involves simulating realistic cyber-attacks by skilled professionals to identify vulnerabilities, weaknesses, and potential breaches in security defences. By conducting regular red-teaming exercises, Member States can proactively identify and address cybersecurity gaps, test incident response procedures, and strengthen the overall cybersecurity posture of neurotechnology devices. Furthermore, red-teaming fosters a culture of continuous improvement and readiness

to respond effectively to evolving cyber threats, ultimately enhancing the security and resilience of neurotechnology ecosystems.

VI. IMPLEMENTATION

[To be completed at a later stage.]

VII. PROMOTION OF THIS RECOMMENDATION AND FINAL PROVISIONS

[To be completed at a later stage.]