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NEUROTECHNOLOGY AND THE LAW: PROTECTING COGNITIVE LIBERTY IN THE AGE OF BRAIN-DATA SURVEILLANCE.

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-This paper examines the implications of emerging neurotechnologies on mental privacy and argues for the recognition of cognitive liberty as a fundamental human right requiring legal protection.

1. Introduction

The rapid development of neurotechnology marks a significant shift in the relationship between technology and human cognition. Devices capable of capturing and analysing neural signals have transformed the human brain into a new source of data, creating both opportunities and risks. While such innovations hold promise in areas such as medical treatment and human enhancement, they simultaneously raise serious concerns regarding mental privacy and individual autonomy.

Cognitive liberty, understood as the right of individuals to exercise control over their own mental processes and to remain free from external interference, is increasingly under pressure in this evolving technological landscape. Unlike conventional personal data, information derived from neural activity has the capacity to reveal deeply intimate aspects of a person's thoughts, emotions and behavioural tendencies. This makes the protection of such data particularly critical.

This paper seeks to examine the legal challenges posed by the rise of neurotechnology and the consequent risks to cognitive liberty. It evaluates whether existing legal frameworks—particularly those relating to privacy and data protection—are sufficient to address these

concerns, or whether new rights, often described as “neurorights”, are required. In addition, the paper explores alternative conceptual approaches, including the theory of contextual integrity, as a means of regulating the use of brain data. The analysis is guided by key questions concerning the adequacy of current legal protections, the nature of emerging threats, and the appropriate legal response to safeguard mental autonomy in the digital age.

2. Threats to Mental Privacy and Cognitive Liberty

The capabilities of modern neurotechnologies extend far beyond traditional methods of data collection. Technologies such as non-invasive brain-computer interfaces and implantable neural devices are capable of capturing real-time neural activity, thereby enabling unprecedented access to the human mind. This form of data collection differs qualitatively from other forms of surveillance, as it directly engages with an individual’s internal mental states.

As noted in contemporary scholarship, while concerns relating to brain data may resemble broader data privacy issues, the sensitivity and depth of neural information render these concerns significantly more serious.¹ Neural data is uniquely revealing, as it can disclose information that individuals may not even consciously choose to express, thereby raising fundamental questions about the limits of permissible data access.

Examples of Key Threats

a) Intrusion into Mental Privacy

Neurotechnologies possess the capacity to expose highly sensitive information relating to an individual’s thoughts and emotions. Even where such data is collected for legitimate purposes, such as medical research, the risk of unauthorised access or misuse cannot be overlooked. The potential disclosure of intimate mental content represents a profound intrusion into personal autonomy. It has been argued that the protection of brain data forms part of the core of human dignity, requiring the highest level of legal safeguarding.²

b) Manipulation and Cognitive Interference

Beyond passive data collection, neurotechnology raises the possibility of active intervention in mental processes. Concerns have been expressed regarding the potential for “brain hacking” or other forms of unauthorised interference, whereby neural signals may be altered to influence thoughts, emotions or decision-making. Such developments would pose a direct threat to cognitive liberty, undermining the individual’s ability to

think and act independently.³

c) Data Aggregation and Predictive Inference

Even where neural data is anonymised, advances in data analytics may allow for the reconstruction or inference of personal characteristics. Aggregated brain data could be used to predict behavioural patterns, psychological vulnerabilities or future actions. This raises concerns about the secondary use of data collected for legitimate purposes, particularly where individuals are unaware of the extent to which their information may be analysed or repurposed.

d) Expansion of Surveillance Practices

The application of neurotechnology in sectors such as criminal justice and commercial marketing further intensifies these risks. In the context of law enforcement, there is growing concern that brain-based technologies could be used for purposes such as lie detection or assessing criminal intent. Similarly, in commercial settings, neural data may be exploited to influence consumer behaviour through targeted advertising. These developments risk normalising intrusive forms of surveillance that extend beyond observable conduct into the realm of thought itself, thereby eroding the boundaries of mental privacy.

3. Existing Legal Frameworks Addressing Brain-Data Surveillance

Overview of Current Legal Protections

Existing legal frameworks for privacy protection often revolve around established human rights, including the right to privacy, the right to freedom of thought, and the right to bodily integrity.⁴ These protections are enshrined in documents like the Universal Declaration of Human Rights, the International Covenant on Civil and Political Rights⁵, and various regional human rights instruments. However, the fast-paced evolution of neurotechnologies presents new challenges that may stretch the boundaries of these protections.

Analysis of Gaps in Existing Frameworks

- **Traditional Privacy vs. Neural Privacy:** Although the current legal regimes provide robust protection against invasion of privacy, the nature of neural data challenges the traditional boundaries of what is considered private information.
- **Adequacy of Freedom of Thought:** Freedom of thought is a well-established human right that implicitly encompasses cognitive liberty; however, its application in the context of modern neurotechnologies remains ambiguous

- Regulatory Challenges in Cross-Sectoral Data Flow:** The pervasive digitisation of data, including brain data, creates complex flows across different sectors. This causes regulatory hurdles because privacy laws designed for conventional digital information may not effectively relate to neural data streams, where context-specific elements are crucial.⁶

Table: Comparison of Legal Frameworks and Their Gaps

Legal Instrument	Coverage	Potential Gaps for Neurotechnology
Universal Declaration of Human Rights (UDHR)	Right to privacy and freedom of thought	Does not specifically address the sensitivity of neural data.
International Covenant on Civil and Political Rights (ICCPR)	Protections regarding privacy and free expression	Lacks clear guidelines for technological data surveillance involving brain data.
Regional Human Rights Instruments (e.g., ECHR, CFR)	Generally robust privacy and dignity protections	Ambiguity in application to instantaneous, high-resolution neural data flows.
National Privacy Laws	Varying degrees of protection for personal data	Often not tailored to address the specialised nature of neurotechnological data.

The comparative analysis demonstrates that while existing human rights instruments provide a foundational framework for privacy protection, they remain insufficiently equipped to address the unique challenges posed by neurotechnological data.⁷

4. Proposals for New Rights (Neurorights)

The concept of “neurorights” has emerged as a response to the inadequacies of existing legal protections.⁸ Proponents argue that traditional frameworks do not adequately safeguard against the unique risks posed by neurotechnologies. Neurorights typically centre on three core areas:

- Mental Privacy:** The right to keep one’s brain data confidential and protected⁹ from unauthorised access or misuse.
- Mental Integrity:** The right to maintain the inviolability of one’s mental state, preventing external manipulation¹⁰ or unauthorized alterations

- 3. Cognitive Liberty:** The right to self-determine one's own mental states and to be free from coercive interventions that may infringe upon personal autonomy.¹¹

Arguments Supporting New Neurorights

Supporters of neurorights maintain that:

- **Technological Specificity:** Neurotechnologies provide a novel form of surveillance by directly accessing internal mental states, requiring specific legal measures.¹²
- **Enhanced Protection:** The sensitive nature of brain data necessitates enhanced legal protections that extend beyond conventional privacy laws.
- **Moral Imperative:** Since cognitive liberty underpins personal autonomy and freedom of thought, it is morally imperative to enshrine this right explicitly in law.

Critiques of Neurorights

Not all scholars agree on the necessity of introducing entirely new rights. Critics argue that:

- **Overlapping Protections:** The Existing human rights laws may already cover key aspects of mental privacy and freedom of thought when properly interpreted.¹³
- **Risk of Fragmentation:** The proliferation of new rights specific to neurotechnology may dilute the coherence of existing privacy frameworks, thereby weakening overall protections.¹⁴
- **Focus on Context:** Instead of establishing new rights, a more effective approach may be used in adopting context-specific frameworks like Nissenbaum's theory of contextual integrity¹⁵, which better account for social norms and information flows.

Diagram: Neurorights Debate Flowchart

Below is a Mermaid flowchart that illustrates the debate between creating new neurorights versus adapting existing legal frameworks:

Neurotechnology Emergence



Increased Brain Data Collection



Threat to Mental Privacy



Threat to Mental Integrity



Threat to Cognitive Liberty

↓

Proposal: New Neurorights

↓

Existing Legal Protections

↓

Enhancement of Current Laws

↓

Contextual Integrity Approach

Flowchart illustrating the balance between proposals for new neurorights and the enhancement of existing legal protections through the contextual integrity approach.¹⁶

5. The Contextual Integrity Approach in Neurotechnology Overview of Contextual Integrity

The idea of contextual integrity, introduced by Helen Nissenbaum, offers a detailed perspective on privacy by placing it within distinct social settings instead of viewing it as a singular or absolute entitlement. According to this framework, privacy is maintained when the sharing of information is consistent with the norms, expectations, and purposes that define a specific context. This perspective highlights two main aspects: firstly, that information should be utilised appropriately within the context where it originates; and secondly, that the gathering and sharing of data must align with accepted social norms and expectations. Unlike inflexible privacy models, contextual integrity provides a more adaptable and responsive framework, making it especially relevant for overseeing new technologies like neurotechnology. Considering the extremely sensitive nature of brain data, which can reveal deeply personal cognitive and emotional states, contextual integrity provides a valuable lens through which to evaluate how such data should be handled across different domains.¹⁷

Application to Neurotechnology

When applied to neurotechnology:

- **Healthcare:** In medical settings, neurotechnologies are often employed for therapeutic and research purposes, with data collection typically grounded in informed consent. Within this context, the use of brain data is generally considered legitimate when it

aligns with clinical objectives and patient expectations. However, contextual integrity requires that such data not be repurposed beyond its intended medical use without explicit authorisation.¹⁸

- **Criminal Justice:** The use of neurotechnology in law enforcement, such as brain-based lie detection or cognitive assessment tools, raises significant concerns regarding coercion and the erosion of mental autonomy. While such tools may enhance investigative capabilities, their deployment must be carefully regulated to ensure that individual rights—particularly the right to freedom of thought—are not compromised. Contextual integrity can assist in defining strict boundaries for acceptable use in this domain.¹⁹
- **Consumer Marketing:** In the commercial sphere, neurotechnologies may be utilised to analyse consumer preferences and behaviour. However, the expectations of individuals in this context differ substantially from those in healthcare or criminal justice. The use of brain data for targeted advertising or behavioural manipulation raises serious ethical concerns, particularly where consent is unclear or insufficient. A contextual integrity approach would require heightened safeguards and stricter limitations on data exploitation.²⁰

Advantages of the Contextual Integrity Approach

- **Flexibility:** Allows legal regulators to tailor protections based on specific contexts rather than imposing blanket rules that may be too rigid.
- **Social Norms:** Recognises that privacy expectations vary across different sectors, thereby leading to more culturally and socially informed regulations.
- **Prevents Overregulation:** By adapting existing rights to consider contextual nuances, there is less risk of creating overlapping or conflicting legal regimes.

6. Case Studies: Healthcare, Criminal Justice, and Consumer Domains

6.1 Healthcare

In the realm of healthcare, neurotechnologies offer immense potential for diagnosing and treating neurological conditions.²¹ Brain-computer interfaces and neural prostheses are increasingly used in medical settings for rehabilitation and treatment of disorders such as epilepsy or Parkinson's disease. However, the collection and usage of brain data in healthcare bring forth significant concerns regarding patient consent, data security, and privacy.²²

- **Data Sensitivity:** Patients' neural data is among the most sensitive forms of personal

information due to its direct link to cognitive functions and identity.

- **Regulatory Measures:** Current medical data regulations, including those governing electronic health records, do not necessarily account for the unique characteristics of brain data. There is a critical need for policies that specifically address the nuances of neural information.²³
- **Proposed Safeguards:** for technical safeguards in neural prostheses to prevent unauthorised detection, alteration, and diffusion of brain data.²⁴ This could involve embedding monitoring systems that alert if neural data is being accessed improperly.

6.2 Criminal Justice

In the criminal justice domain, the potential application of neurotechnologies includes lie detection and the assessment of criminal intent through brain-reading tools. While such applications could enhance investigative methods, they also pose dramatic risks to civil liberties.

- **Privacy vs. Public Safety:** The deployment of brain-reading technologies requires a delicate balance between ensuring public safety and preserving individual mental privacy.
- **Legal Ambiguities:** Current laws may not adequately define the boundaries of acceptable use when it comes to neural data in forensic contexts. The risk here is not merely the collection of data but the possibility of misinterpretation and subsequent wrongful outcomes.²⁵
- **Contextual Norms:** Application of the contextual integrity framework can help in setting context-specific guidelines that determine how and when neural data may be used in law enforcement. For instance, obtaining clear consent and establishing strict protocols could mitigate potential abuses.

6.3 Consumer Marketing

The commercial use of neurotechnologies extends to consumer marketing, where companies could leverage brain data analytics to customise advertising. This raises questions about consent and the potential exploitation of individuals' mental states.

- **Exploitation Risks:** Without effective regulation, consumer brain data might be used to build detailed psychological profiles, leading to manipulative marketing practices.
- **Existing Oversight:** Traditional consumer protection laws do not currently extend to the neural domain, highlighting a gap that must be addressed²⁶ either through new legal

measures or by adapting existing frameworks.

- **Transparency and Consent:** Ensuring that consumers are fully aware of how their brain data is collected and used is paramount. Transparency initiatives and tighter consent requirements²⁷ are critical reforms needed in this sector.

Visual Table: Comparison of Case Studies

Sector	Key Neurotechnology Application	Primary Risks	Policy Needs
Healthcare	Neural prostheses, BCIs for treatment and rehabilitation	Inadequate consent, potential data breaches, and misinterpretation of diagnostic data	Specific safeguards in medical device regulation, strict consent protocols
Criminal Justice	Brain-reading tools for lie detection and intent assessment	Intrusion into mental privacy, misapplication leading to wrongful convictions	Clear legal guidelines, contextual privacy norms, and strong oversight mechanisms
Consumer	Targeted advertising based on neural data	Exploitation of personal data, manipulation through tailored marketing practices	Transparency initiatives, strict consent requirements, and data protection measures

7. Technical and Policy Solutions for Protecting Cognitive Liberty

7.1 Technical Safeguards

One hopeful avenue for protecting cognitive liberty lies in the technical design of neural devices. Key technical safeguards include:

- **Detection Systems:** Integration of systems that continuously monitor for unauthorised access or abnormal activity in neural data. Such systems would alert both the user and relevant regulatory bodies in case of a breach.
- **Data Encryption and Access Controls:** Implementation of robust encryption methods to ensure that neural data remains confidential and is only accessible to authorised individuals.
- **Fail-Safe Mechanisms:** Design neural devices with built-in fail-safe functions that can

immediately terminate data transmission if suspicious activity is detected.

- **User-Controlled Access:** Devices should be tailored so that users retain ultimate control over their neural data, including managing who can access it and under what circumstances.

7.2 Policy Reforms

Legal and policy reforms are essential to complement technical safeguards and create a holistic protective framework for cognitive liberty. Proposed policy solutions include:

- **Explicit Recognition of Neurorights:** As argued by proponents of neurorights, explicit legal recognition of mental privacy, mental integrity, and cognitive liberty would crystallise the moral imperatives underlying these protections. Such recognition could take the form of national constitutional amendments or international legal instruments.
- **Contextual Privacy Regulations:** Adopt a framework based on contextual integrity. Under this framework, data usage constraints would be tailored to the specific context in which neural data is used, differentiating between clinical, law enforcement, and commercial contexts.
- **Enhanced Consent Protocols:** Strengthen informed consent procedures to ensure individuals are fully aware of the potential risks and the uses of their brain data in all applications of neurotechnology.
- **Regulatory Oversight Bodies:** Establish independent oversight agencies dedicated to monitoring the development and deployment of neurotechnologies. Such bodies should have the authority to enforce technical and policy standards and to impose penalties for violations.
- **Interdisciplinary Collaboration:** To keep legal frameworks aligned with rapidly advancing technology, encourage ongoing collaboration among neuroscientists, legal scholars, ethicists, policymakers, and industry stakeholders to improve technology measurements and legal frameworks.²⁸

Policy and Technical Safeguard Integration

The protection of cognitive liberty necessitates an integrated framework combining both technical safeguards and policy reforms. On the technical side, measures such as detection systems, encryption and access controls, and fail-safe mechanisms are essential to ensure the security and integrity of brain data. Simultaneously, policy reforms—including the recognition of explicit neurorights, the formulation of contextual privacy regulations, and the strengthening

of informed consent requirements—provide the necessary legal and ethical foundation. Together, these technical and regulatory measures form a comprehensive approach to safeguarding cognitive liberty in the age of neurotechnology.

8. Conclusion

Emerging neurotechnologies deliver tremendous benefits to industries as diverse as health, law enforcement, and consumer analytics, law enforcement, and medical. They do, however, also present serious threats to cognitive liberty and mental privacy. This paper shows that the special sensitivity of neurological data calls for both a reconsideration of current legal frameworks and the possible creation of new neurorights. Some academics focus on improving current protections through a context-specific framework based on Nissenbaum's idea of contextual integrity, while others support the explicit legal acknowledgement of mental privacy, mental integrity, and cognitive liberty.

Key Findings:

- **Mental Privacy and Cognitive Liberty are Under Threat:** The direct monitoring of neural activity exposes intimate details of thought processes, making cognitive liberty a critical human right that demands robust protections.
- **Existing Legal Frameworks are Inadequate:** Traditional privacy and freedom of thought laws do not fully encompass the unique risks posed by neurotechnology, necessitating either enhanced interpretation or the creation of new legal norms.
- **Debate Over Neurorights:** While proponents of neurorights argue that new, specialised legal rights are essential, critics caution that modifying existing frameworks and adopting contextual integrity may provide a more cohesive solution.
- **Integration of Technical Safeguards:** Embedding technical safeguards within neural devices is a promising approach to prevent unauthorised access and manipulation of neural data, thereby reinforcing legal protections.
- **Context-Specific Regulation:** More effective and socially conscious privacy protections are ensured when privacy regulations are tailored to the various situations in which neurological data is gathered and used, such as consumer marketing, criminal justice, or healthcare. In conclusion, safeguarding cognitive freedom in the era of brain-data surveillance necessitates a multipronged strategy that includes technological advancements, legislative changes, and regulatory frameworks tailored to particular situations. Society can only guarantee that the advantages of neurotechnology are

realised without jeopardising people's fundamental rights to mental privacy and freedom of thinking by including these components.

This research paper highlights that protecting cognitive liberty is crucial not only for safeguarding individual autonomy and privacy but also for ensuring that technological advancements uphold the fundamental values of human dignity. It calls for increased interdisciplinary dialogue, further research, and innovative policy development to effectively tackle the challenges posed by the fast-evolving field of neurotechnology.

¹ Daniel Susser and Laura Y Cabrera, 'Brain Data in Context: Are New Rights the Way to Mental and Brain Privacy?' (2023) 15(2) *AJOB Neuroscience* 122.

² Andrea Lavazza, 'Freedom of Thought and Mental Integrity: The Moral Requirements for Any Neural Prosthesis' (2018) 12 *Frontiers in Neuroscience* 82.

³ *ibid*

⁴ Universal Declaration of Human Rights (adopted 10 December 1948 UNGA Res 217 A(III)) arts 12, 18.

⁵ International Covenant on Civil and Political Rights (adopted 16 December 1966, entered into force 23 March 1976) 999 UNTS 171 arts 17, 18.

⁶ Sjors Ligthart and others, 'Minding Rights: Mapping Ethical and Legal Foundations of "Neurorights"' (2023) 32(4) *Cambridge Quarterly of Healthcare Ethics* 461.

⁷ European Convention on Human Rights (adopted 4 November 1950, entered into force 3 September 1953) arts 8, 9; Charter of Fundamental Rights of the European Union [2012] OJ C326/391 arts 7, 8.

⁸ Marcello Ienca and Roberto Andorno, 'Towards New Human Rights in the Age of Neuroscience and Neurotechnology' (2017) 13(1) *Life Sciences, Society and Policy* 5.

⁹ Nita A Farahany, 'The Costs of Changing Our Minds' (2012) 94 *Texas Law Review* 75.

¹⁰ Jan Christoph Bublitz and Reinhard Merkel, 'Crimes Against Minds: On Mental Manipulations, Harms and a Human Right to Mental Self-Determination' (2014) 8 *Criminal Law and Philosophy* 51.

¹¹ Richard Glen Boire, 'On Cognitive Liberty' (2001) *Journal of Cognitive Liberties* 7.

¹² UNESCO, 'Report of the International Bioethics Committee on the Principle of Respect for Human Vulnerability and Personal Integrity' (2013).

¹³ European Convention on Human Rights (adopted 4 November 1950, entered into force 3 September 1953) arts 8, 9.

¹⁴ Orla Lynskey, *The Foundations of EU Data Protection Law* (OUP 2015) 215.

¹⁵ Helen Nissenbaum, *Privacy in Context: Technology, Policy, and the Integrity of Social Life* (Stanford University Press 2010).

¹⁶ Author's own illustration.

¹⁷ Luciano Floridi, 'On Human Dignity as a Foundation for the Right to Privacy' (2016) 29(4) *Philosophy and Technology* 307.

¹⁸ Barbara J Evans, 'Much Ado About Data Ownership' (2011) 25(1) *Harvard Journal of Law and Technology* 69.

¹⁹ Nita A Farahany, 'Incriminating Thoughts' (2016) 64 *Stanford Law Review* 351.

²⁰ Federal Trade Commission, 'Protecting Consumer Privacy in an Era of Rapid Change' (FTC Report, 2012).

²¹ Marcello Ienca and Roberto Andorno, 'Towards New Human Rights in the Age of Neuroscience and Neurotechnology' (2017) 13 *Life Sciences, Society and Policy* 5.

²² World Health Organisation, *Ethics and Governance of Artificial Intelligence for Health* (WHO 2021).

²³ OECD, *Recommendation on Responsible Innovation in Neurotechnology* (2019).

²⁴ Marcello Ienca, 'Common Human Rights Challenges Raised by Different Applications of Neurotechnologies' (Council of Europe, 2021).

²⁵ Jane Campbell Moriarty, 'fMRI and Lie Detection: The Good, the Bad, and the Ugly' (2008) 44 *American Criminal Law Review* 121.

²⁶ European Parliament, *Neurotechnology and Human Rights* (2021).

²⁷ GDPR (n 4) arts 7, 12–14.

²⁸ OECD, 'Recommendation on Responsible Innovation in Neurotechnology' (OECD Legal Instruments, 2019).