Brain-computer interfaces and the decoding of thoughts as personal mental data[1]

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Resumo: A neurotecnologia é um campo em constante metamorfose que se encontra a redefinir a nossa compreensão do cérebro, principalmente através de Interfaces Cérebro-Computador (ICC) que permitem interpretar sinais elétricos ou modificar a atividade cerebral. Existindo o risco dos ICC poderem aceder à mente, e por consequência, ler pensamentos, o presente artigo pretende analisar esta questão à luz do Regulamento Geral de Proteção de Dados (RGPD). Na nossa opinião os pensamentos são Dados Mentais pessoais, com um elevado grau de sensibilidade, que devem ser tutelados pelo RGPD através da expansão do artigo 9.º deste regulamento pela decisão do Tribunal Europeu C-184/20.

Palavras-chave: *Dados Mentais; Interface Cérebro-Computador; Pensamentos; Regulamento Geral sobre a Proteção de Dados*.

Abstract: Neurotechnology is a field in constant metamorphosis that is redefining our understanding of the brain, mainly through Brain-Computer Interfaces (BCI) that makes it possible to interpret electrical signals or modify brain activity. Since there is a risk that BCI could access the mind and, consequently, read thoughts, this article aims to

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analyse this issue in the light of the General Data Protection Regulation (GDPR). In our opinion, thoughts are personal Mental Data, with a high degree of sensitivity, which should be protected by the GDPR through the expansion of Article 9 of this regulation by European Court decision C-184/20.

***Key Words**: Brain-Computer Interfaces; General Data Protection Regulation; Mental Data; Thoughts*

1. Introduction

Most of the media examples, from the movie *The Matrix*[3] to *Inception*[4] and the series *Black Mirror*[5], generally paint a dystopian future for Brain Interface Technologies. They tell us a story of thought manipulation or behavioural mind control, a loss of humanness through an over reliance on technology, the ability for others to peer into our thoughts and memories or other dangerous effects when we express it in devices connected directly to our brains.

Since 2013[6], billions of euros have been allocated towards studying the human brain in the European Union, the United States of America and even China. This focus can be determined by the 'natural progression of behavioral studies that aim to demystify the unknown mechanisms behind the interaction of billions of neurons that make up the human brain'.[7] As there are at least a billion people on the planet who have

[3] Chicago. Wachowski, Lana, and Lilly Wachowski. 1999. The Matrix. United States: Warner Bros.

[4] Chicago. Nolan, Christopher. 2010. Inception. United States: Warner Bros.

[5] "The History of You", Black Mirror, Brian Welsh, Jesse Armstrong, season 1 episode 3, december 2011.

[6] Sten Grillner et al., "Worldwide Initiatives to Advance Brain Research," Nature Neuroscience 19, no. 9 (August 26, 2016): 1118–22. Available at: https://www.nature.com/articles/nn.4371.

[7] "Neurotechnologies: Connecting Human Brains to Computers and Related Ethical Challenges (ATP) – Policy Briefs & Reports – EPTA Network," (May 2019). Available at: https://eptanetwork.org/database/policy-briefs-reports/1792-neurotechnologies-connecting-human-brains-to-computers-and-related-ethical-challenges-atp.

disabilities,[8] it becomes a relevant opportunity to improve the lives of these people through technology capable of pursuing the interest of public and private health, however expensive research in the neuronal area, like for example Alzheimer's disease research,[9] may be.

'Neurotechnologies are emerging technologies that establish a connection pathway to the human brain through which human neuronal activity can be recorded and/or altered'[10] and are already being used, among others, to map brain regions related to different neuronal functions, to provide an image of the brain, and to repair its specific damaged areas.[11] These 'innovations have been found to facilitate the communication between the brain'[12] and the machines, such as orthoses and prostheses that have proven to be efficient and effective for the treatment of Parkinson's, blindness and other diseases and limitations by interpreting data from brain activity.

The brain is a physiological organ composed of nervous tissue, that commands task-evoked responses, movement, senses, emotions, language, communication, thinking, and memory.[13] Brain activity is the basis of cognitive, affective, and survival state, being relevant to the extent that in many countries, 'death is legally defined by irreversible

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[8] World Health Organization, "World Report on Disability 2011, page 11. Available at: https://apps.who.int/iris/handle/10665/44575.

[9] Alzheimer's association, 'Alzheimer's Breakthrough Act', august 2012. Available at: https://act.alz.org/site/DocServer/2012_ABA_Fact_Sheet.pdf;jsessionid=00000000.app20005a?docID=1921&NONCE_TOKEN=275A51DABCD7F1949DACF9680ADD25D1.

[10] Committee on Bioethics (DH-BIO) of the Council of Europe and Marcello Ienca, "Neurotechnologies and Human Rights Framework: Do We Need New Rights?," October 2021, page 6. Available at: https://rm.coe.int/report-final-en/1680a429f3.

[11] "Neurotechnology: Premises, Potential, and Problems," Routledge & CRC Press, n.d., page 2-3. Available at: https://www.routledge.com/Neurotechnology-Premises-Potential-and--Problems/Giordano/p/book/9781439825860.

[12] Raimundo Roberts, "Neurotechnologies: Connecting Human Brains to Computers and Related Ethical Challenges," Biblioteca Del Congreso Nacional De Chile / BCN, May 2019, available at: https://obtienearchivo.bcn.cl/obtienearchivo?id=repositorio/10221/28289/1/If01_Neurotechnologies_BCN_eng.pdf.

[13] Maldonado, Kenia A., and Khalid Alsayouri. 2023. "Physiology, Brain." StatPearls – NCBI Bookshelf. March 17, 2023. https://www.ncbi.nlm.nih.gov/books/NBK551718/.

cessation of brain activity'[14] or the brainstem functions.[15] The centrality of this notion to others like human identity, freedom of thought, autonomy, privacy, and human well-being means that the ethical, legal and societal impact of recording and/or modulating brain activity through various devices and procedures is vitally important to consider.[16]

The neurotechnology that is revolutionizing 'our understanding of the brain and its interaction with technology'[17] is the Brain-Computer Interface (BCI). BCI manifest themselves in a collaboration between the human brain and an electronic device that receives signals from the brain to command an external activity, more specifically, 'a system that measures central nervous system (CNS) activity and converts it into an artificial output (response) that replaces, restores, complements, or enhances the output of the natural CNS and thereby modifies the ongoing interactions between the CNS and its external or internal environment'.[18]

The examination of how data from Brain-Computer Interfaces is categorized under data protection laws becomes complex when considering that not all data revealing physiological conditions of the brain can be directly linked to sensitive data, in the provisions of article 9 of the GDPR. This complexity arises because the source of this data is the brain or the mental state of the data subject, which does not automatically imply sensitivity. According to the definition of article 4(1) of the

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[14] International Bioethics Committee, "Report of the International Bioethics Committee of UNESCO (IBC) on the Ethical Issues of Neurotechnology," December 2021, page 6. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000378724, page 4.

[15] As defined in the Portuguese legal framework in Law 141/99 of 28 August that establishes the principles upon which the verification of death is based.

[16] Report of the International Bioethics Committee of UNESCO (n 14), page 4.

[17] Neuroscience News, "Interfacing Minds and Machines: An Exploration of Neural Implants and Brain-Computer Interfaces," June 17, 2023. Available at: https://neurosciencenews.com/brain-computer-interfact-neural-implants-23492/.

[18] Jonathan R. Wolpaw et al., "Brain–Computer Interfaces for Communication and Control," Clinical Neurophysiology 113, no. 6 (June 1, 2002): 767–91. Available at: https://doi.org/10.1016/s1388-2457(02)00057-3 in Raimundo Roberts (n 13), page 2-3.

GDPR, as in WP29 Guidelines[19], and the Court of Justice of the European Union, CJEU, cases Breyer[20] and Nowak[21] data that is related to the 'human brain and mind are always personal data if they allow to single out the data subject at stake'.[22] There is also a discussion in the doctrine regarding the relationship between Mental Data and brain data[2324] within the fact that 'not all brain data are Mental Data as brain data can be processed to infer not only mental states but also basic brain anatomy and physiology, without disclosing mental states and processes'.[25]

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[19] ARTICLE 29 DATA PROTECTION WORKING PARTY, "Opinion 05/2014 on Anonymisation Techniques," April 2014, https://ec.europa.eu/justice/article-29/documentation/opinion-recommendation/files/2014/wp216_en.pdf.

[20] JUDGMENT OF THE COURT (Second Chamber), "Patrick Breyer v Bundesrepublik Deutschland in Case C-582/14," October 2016, [30]. https://curia.europa.eu/juris/document/document.jsf;jsessionid=C46DB40CAC700B9AE3435EF04893B20C?text=&docid=184668&pageIndex=0&doclang=en&mode=lst&dir=&occ=first&part=1&cid=1228188

[21] Judgment of the Court (Second Chamber), "Peter Nowak v Data Protection Commissioner in Case C-434/16," December 2017, https://curia.europa.eu/juris/document/document.jsf?text=&docid=198059&pageIndex=0&doclang=en&mode=lst&dir=&occ=-first&part=1&cid=1229492.

[22] Frederik J. Zuiderveen Borgesius, "Singling out People without Knowing Their Names – Behavioural Targeting, Pseudonymous Data, and the New Data Protection Regulation," Computer Law & Security Review 32, no. 2 (April 1, 2016): page 32, https://doi.org/10.1016/j.clsr.2015.12.013 in Marcello Ienca and Gianclaudio Malgieri, "Mental Data Protection and the GDPR," Social Science Research Network, January 1, 2021, page 8, https://doi.org/10.2139/ssrn.3840403.

[23] Authors that argue that neural data have a direct causal link with mental processes: Marcello Ienca, Pim Haselager, and Ezekiel J. Emanuel, "Brain Leaks and Consumer Neurotechnology," Nature Biotechnology 36, no. 9 (October 1, 2018): 805–10, https://doi.org/10.1038/nbt.4240; Marcello Ienca and Roberto Andorno, "Towards New Human Rights in the Age of Neuroscience and Neurotechnology," Life Sciences, Society and Policy 13, no. 1 (April 26, 2017), https://doi.org/10.1186/s40504-017-0050-1; Marcello Ienca and Karolina Ignatiadis, "Artificial Intelligence in Clinical Neuroscience: Methodological and Ethical Challenges," Ajob Neuroscience 11, no. 2 (March 31, 2020): 77–87, https://doi.org/10.1080/21507740.2020.1740352; Rafael Yuste et al., "Four Ethical Priorities for Neurotechnologies and AI," *Nature* 551, no. 7679 (November 1, 2017): 159–63, https://doi.org/10.1038/551159a.

[24] Example of an author that criticizes the division of neural data from brain data due to limited accuracy and reliability of the current available neurodevices: Anna Wexler, "Separating Neuroethics from Neurohype," Nature Biotechnology 37, no. 9 (August 9, 2019): 988–90, https://doi.org/10.1038/s41587-019-0230-z.

[25] Marcello Ienca and Gianclaudio Malgieri (n 22) page 7.

However, when considering the content, context, and purpose of data processing,[26] it's possible that these types of data might reveal information related to the sensitive categories defined in Article 9(1) of the GDPR. This creates a conceptual and normative gap,[27] as authors have discussed regarding the protection gap in all Mental Data and the definition of 'special categories of data' being either purpose-based[28] or mostly contextual.[29]

This article aims to qualitatively and descriptively analyse the legal and ethical issues related to BCI and the possible use of mental data, based on secondary sources and normative and jurisprudential legal interpretation. I intend to critically analyze the intersection of data captured and managed by Brain-Computer Interfaces, with 'the most comprehensive and progressive piece of data protection legislation in the world, updated to deal with the implications of the digital age',[30] the GDPR, addressing the complex challenges and implications arising from these technological advancements, to be able to answer the following pivotal questions: Does the technological capacity of BCI extend to the point of processing human thoughts? Are thoughts, in essence, mental or brain/neural data? Are thoughts personal data under the GDPR? Let's examine.

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[26] Paul Quinn and Gianclaudio Malgieri, "The Difficulty of Defining Sensitive Data–The Concept of Sensitive Data in the EU Data Protection Framework," German Law Journal 22, no. 8 (December 1, 2021): 1583–1612, https://doi.org/10.1017/glj.2021.79; Karen McCullagh, "Data Sensitivity: Proposals for Resolving the Conundrum," Neliti, 2007, https://www.neliti.com/publications/28727/data-sensitivity-proposals-for-resolving-the-conundrum.

[27] Stephen Rainey et al., "Is the European Data Protection Regulation Sufficient to Deal with Emerging Data Concerns Relating to Neurotechnology?," Journal of Law and the Biosciences 7, no. 1 (January 1, 2020), https://doi.org/10.1093/jlb/lsaa051.

[28] Ibid, page 14, 16 and 17.

[29] Marcello Ienca and Gianclaudio Malgieri (n 22) states that 'According to the contextual approach in the GDPR, all personal data should be assessed against the background of the context that determines their processing, as determined by several contextual factors (eg the specific interests of the controller, the potential recipients of the data, the aims for which the data are collected, the conditions of the processing and its possible consequences for the persons involved). In contrast, the purpose-based approach essentially looks at the intention of the data controller and asks whether the controller intends to draw conclusions from the processing of particular data that could be regarded as being sensitive in nature.'

[30] "Data Protection," European Data Protection Supervisor, January 25, 2024, https://edps.europa.eu/data-protection_en.

2. Brain-Computer Interfaces and the Decoding of Brain Signals

The goal of a BCI is to detect and quantify the characteristics of brain signals that indicate the user's intentions and to translate those characteristics in real time into device commands that fulfil the user's intention. The interaction between the user's brain and the BCI system is made in a four-step cycle: input (signal acquisition), measurement and recording of brain activity (feature extraction), decoding and classification (feature translation) and the device output.[31] The input is the generation of specific brain activity, when the user is in certain cognitive state or performs a certain mental task, in response to a stimulus.[32] Brain activity is measured using a particular sensor modality, like the scalp or intracranial electrodes for electrophysiologic activity[33], being amplified to levels suitable for electronic processing, digitized and transmitted to the computer. After the broadcast the brain activity is measured, recorded, and analysed to distinguish pertinent signal characteristics during a cognitive process or the performance of a mental task, to differentiate noise,[34] random or unwanted electrical signals that distort the intended to be captured, and extraneous content from the user's intent. 'The recorded measurement can be implemented in different ways depending on the type of BCI in use'[35] being the most common way to extract the signal, a BCI time-triggered by

[31] Jerry J. Shih, Dean J. Krusienski, and Jonathan R. Wolpaw, "Brain-Computer Interfaces in Medicine," Mayo Clinic Proceedings 87, no. 3 (March 1, 2012): 268–79, https://doi.org/10.1016/j.mayocp.2011.12.008.

[32] Report commissioned by the Committee on Bioethics (DH-BIO) of the Council of Europe (n 11), page 16.

[33] Jerry J. Shih, Dean J. Krusienski, and Jonathan R. Wolpaw, "Brain-Computer Interfaces in Medicine," Mayo Clinic Proceedings 87, no. 3 (March 1, 2012): 268–79, https://doi.org/10.1016/j.mayocp.2011.12.008.

[34] Mohammad Javad Jafari et al., "The Effect of Noise Exposure on Cognitive Performance and Brain Activity Patterns," Open Access Macedonian Journal of Medical Sciences 7, no. 17 (August 30, 2019): 2924–31, https://doi.org/10.3889/oamjms.2019.742.

[35] Committee on Bioethics of the Council of Europe (n 10), page 16.

Electroencephalogram (EEG) or Electrocorticography (ECoG)[36] response latencies and amplitudes or firing rates of individual cortical neurons.

The characteristics of the neural data resulting from the brain signal obtained needs to be decoded to the feature translation algorithm so it can be usable by the BCI. The data is processed to obtain specific determined brain signals 'to increase the signal-to-noise ratio and to filter out the most relevant aspects of each signal for further processing'.[37] 'The translation algorithm should be dynamic to accommodate and adapt to spontaneous or learned changes in the signal features and to ensure that the user's possible range of feature values covers the full range of device control'[38], something that showcases the relevance of Artificial Intelligence and Machine Learning that provides algorithms that are trained to decode the neural signals in an increasingly accurate manner and 'behaviour accurately from time-varying neural oscillations'.[39] The final step represents 'the execution of the action initially intended or desired or deemed beneficial to the user through the control of the applications interfaced by the BCI'.[40] The algorithm commands operationalise the external device, providing functions depending on the goal of the application of the technology, supplying the feedback of the previous cycle, closing the control loop,[41] starting the next cycle for the following external action arise and only then we possess the data relatively clean to train the computers to recognize certain patterns to accomplish different tasks.

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[36] ECoG is an "intracranial recording of EEG but in this case subdural grids are placed directly on the surface of the cortex to record electrical activity from the cerebral cortex" in Jonathan Curot, Thomas Busigny, Luc Valton, et al, "Memory scrutinized through electrical brain stimulation: A review of 80 years of experiential phenomena", Neuroscience & Biobehavioral Reviews, volume 78, 2017, pages 161-177, https://doi.org/10.1016/j.neubiorev.2017.04.018.

[37] Committee on Bioethics of the Council of Europe (n 10), page 17.

[38] Jerry J. Shih (n 33).

[39] Venkatesh Elango, "Sequence Learning for Brain Computer Interfaces," 2017, https://escholarship.org/uc/item/6gn763m3.

[40] Committee on Bioethics of the Council of Europe (n 10), page 17.

[41] James C. Wright et al., "A Review of Control Strategies in Closed-Loop Neuroprosthetic Systems," Frontiers in Neuroscience 10 (July 12, 2016), https://doi.org/10.3389/fnins.2016.00312.

2.1 From Brain to Speech: Decoding of Neural Activity

The current state of this technology, as well as all its potential and splendor, is mirrored in the pivotal scientific study "A high-performance speech neuroprosthesis"[42] focusing on the use of microelectrode arrays[43] to read ECoG of a participant with amyotrophic lateral sclerosis.

These arrays are crucial for capturing spiking activities of neurons in regions linked to speech production. The high-resolution data obtained from these arrays enable detailed and precise recording of neural patterns, forming the backbone of the neuroprosthesis functionality. The decoding process in this study is a sophisticated application of neural engineering and machine learning. At the heart of this process is a five-layer recurrent neural network[44] (RNN) decoder,[45] designed to interpret neural signals associated with speech attempts. This RNN operates by predicting the probability of each phoneme, or sound unit, being spoken at specific time intervals. Every 80 milliseconds[46], the decoder updates its prediction, providing a dynamic and continuous interpretation of the neural data. These phoneme probabilities are then intricately merged with a language model. This model utilizes the statistical characteristics of the English language to deduce the most likely sequence of words that corresponds to the neural signals. This integration is crucial, as it not only decodes the raw neural data into phonemes but also contextualizes these phonemes within the framework of coherent and grammatically accurate language.

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[42] Francis R. Willett et al., "A High-Performance Speech Neuroprosthesis," Nature 620, no. 7976 (August 23, 2023): 1031–36, https://doi.org/10.1038/s41586-023-06377-x.

[43] 'The MEA system enables simultaneous extracellular recordings from multiple sites in the network in real time, increasing spatial resolution and thereby providing a robust measure of network activity' in Andrew F.M. Johnstone et al., "Microelectrode Arrays: A Physiologically Based Neurotoxicity Testing Platform for the 21st Century," NeuroToxicology 31, no. 4 (August 1, 2010): 331–50. Available at: https://doi.org/10.1016/j.neuro.2010.04.001.

[44] 'A recurrent neural network (RNN) is a type of artificial neural network which uses sequential data or time series data' in "What Are Recurrent Neural Networks? | IBM," n.d., https://www.ibm.com/topics/recurrent-neural-networks.

[45] Francis R. Willett et al. (n 42), page 1033.

[46] Ibid, page 1032.

By the final stages of the study, the trained RNN demonstrates remarkable proficiency in decoding speech from neural data in real--time, even for sentences it was never exposed to during training. The evolution of the RNN's capabilities, from initial training to its final high-performance state, is a testament to the potential of machine learning in enhancing neuroprosthetic technologies.

The study's ability to translate neural activities, particularly those associated with speech, into language, highlights the potential of BCI to access and interpret thoughts, on this case a specific subset of thoughts (those related to speech and communication) but the technology operates on the same basic principles: 'they record neural activity – usually electrical activity – associated with a function such as speech or attention; interpret what that activity means; and use it to control an external device or simply provide it as information to the user'.[47] The ability of the BCI system to decode neural signals associated with attempted speech into coherent language offers a glimpse into the possibilities of accessing and interpreting internal speech – a proxy for thought. This finding bridges the gap between the neural activity and complex cognitive processes, indicating that internal speech, an integral part of human thought, could be externalized and understood through advanced BCI systems.

3. Personal Data from the Mind: The Legal Status of Thoughts under the GDPR

Thought is one of the most subjective, intriguing, and complex realities of the human being, to the extent that there is no consensus on its definition. There are authors who say that thought needs to contain

[47] Liam Drew, "The Rise of Brain-Reading Technology: What You Need to Know," Nature 623, no. 7986 (November 8, 2023): 241–43, https://doi.org/10.1038/d41586-023-03423-6.

language or symbolic representation,[48] which makes it a capacity that is exclusively ours, but there are those who say that *flora* can also be capable of thinking.[49] 'Altogether what we have so far are quite remarkable decoding of the input and output signals'[50] which means that modern society cannot yet understand the abstract reality that lies between these signals and that manifests itself in thoughts. Nevertheless, it is necessary, at least attempt, to conceptualize and define the nature of thoughts grasping the relevant scientific contributions of neuroscience and psychology.

From a neuroscientific standpoint, thoughts are understood as the outcome of complex neural processes within the brain, according to the neural theory proposed by Santiago Ramón y Cajal and Camilo Golgi,[51] and how their complex networks and interactions result in the formation of thoughts. When humans think, there is a cascade of electrical and chemical activities in the brain – neural impulses travel through synapses, facilitated by neurotransmitters.[52] Neuroscientists examine the brain's physical and chemical processes to understand how thoughts are formed, mapping specific brain regions[53] and activities associated

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[48] Lera Boroditsky, "How Language Shapes the Way We Think," IRL @ UMSL, n.d., https://irl.umsl.edu/oer/13/.

[49] Monica Gagliano, "The Mind of Plants: Thinking the Unthinkable," Communicative & Integrative Biology 10, no. 2 (February 17, 2017): e1288333, https://doi.org/10.1080/19420889.2017.1288333.

[50] Sapien Labs, "Reading a Thought – Sapien Labs | Neuroscience | Human Brain Diversity Project," Sapien Labs | Neuroscience | Human Brain Diversity Project, August 29, 2022, https://sapienlabs.org/lab-talk/reading-a-thought/.

[51] Santiago Ramón y Cajal, "*Textura del sistema nervioso del hombre y de los vertebrados: estudios sobre el plan estructural y composición histológica de los centros nerviosos adicionados de consideraciones fisiológicas fundadas en los nuevos descubrimientos*", Volumen III, 1904, https://digibug.ugr.es/handle/10481/69715; Camillo Golgi, "*Sulla fina anatomia del cervelletto umano*", Editore Libraio Milano, Milan, Italy, 1874.

[52] David M. Lovinger, "Communication Networks in the Brain: Neurons, Receptors, Neurotransmitters, and Alcohol," ResearchGate, January 1, 2008, https://www.researchgate.net/publication/236181567_Communication_networks_in_the_brain_Neurons_receptors_neurotransmitters_and_alcohol.

[53] Shazia Veqar Siddiqui et al., "Neuropsychology of Prefrontal Cortex," Indian Journal of Psychiatry 50, no. 3 (January 1, 2008): 202, https://doi.org/10.4103/0019-5545.43634, Joel L. Voss et al., "A Closer Look at the Hippocampus and Memory," Trends in Cognitive Sciences 21, no. 8 (August 1, 2017): 577–88, https://doi.org/10.1016/j.tics.2017.05.008.

with different types of thinking.[54] In contrast, psychological studies indicate the subjective experience of thoughts and their role in human behaviour and cognition, being conceptualized as complex mental constructs formed through the interplay of various cognitive unique processes, shaped by a combination of sensory perceptions, memories, experiences, and cultural influences. They represent a dynamic and integral aspect of human cognition, therefore involves not only the individual mind, but also the wider social and cultural context in which the individual operates, being influenced by social and cultural factors in their thought processes, as these are not formed in isolation, but are moulded by social norms, cultural backgrounds, and the social interactions experienced.[55]

Combining these perspectives, I recognise that thoughts are a multifaceted phenomenon: they represent a culmination of various neural activities and interactions, reflecting the complexity of the human cognitive experience, emotional states[56], environmental stimuli[57], and individual differences in brain structure and function,[58] so 'the content of our thoughts and the form they take varies in a complex manner across people, places, and time'.[59] 'Thinking leaves traces in the brain so exploring the mind by studying brain states might be like exploring

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[54] The prefrontal cortex, for instance, plays a key role in higher-order cognitive functions like decision-making, problem-solving, and planning. Meanwhile, areas like the hippocampus are crucial for memory formation and retrieval, a critical aspect of how we think and process information.

[55] "People's Thoughts and Behaviors: Influence of Cultural and Social Factors | Free Essay Example," StudyCorgi, December 3, 2022, https://studycorgi.com/peoples-thoughts-and-behaviors-influence-of-cultural-and-social-factors/.

[56] Chai Meei Tyng et al., "The Influences of Emotion on Learning and Memory," Frontiers in Psychology 8 (August 24, 2017), https://doi.org/10.3389/fpsyg.2017.01454.

[57] Kathryn E. Schertz et al., "Environmental Influences on Affect and Cognition: A Study of Natural and Commercial Semi-Public Spaces," Journal of Environmental Psychology 83 (October 1, 2022): 101852, https://doi.org/10.1016/j.jenvp.2022.101852.

[58] Jenny Gu and Ryota Kanai, "What Contributes to Individual Differences in Brain Structure?," Frontiers in Human Neuroscience 8 (April 28, 2014), https://doi.org/10.3389/fnhum.2014.00262.

[59] Jonathan Smallwood et al., "The Neural Correlates of Ongoing Conscious Thought," iScience 24, no. 3 (March 1, 2021): 102132, https://doi.org/10.1016/j.isci.2021.102132.

an elephant by studying its footprints'[60] so I can affirm that thoughts are not just the product of brain activity, but rather the *a priori* cause of manifested brain activity.

Each individual's thought processes are a unique blend of their neural patterns, cognitive functions, emotional experiences, personal social constraints, but also information that are physically encoded in matter,[61] where the 'software' of the mind takes precedence over the 'hardware' of the brain.[62] Therefore, the brain is a facilitator of thought processes, supporting and realizing the mind's cognitive functions, functional capacities and emergent properties, but not being the sole originator of thoughts themselves.

Based in what I have outlined, neural activity in the brain forms the substrate from which thoughts emerge, suggesting a causal link between brain function and the generation of thoughts, but just as these have emerged, they are not simply reduced to their neurological underpinnings, occupying a distinct realm within the mind, characterized by subjective experience and qualitative richness that neural processes alone cannot fully encapsulate.[63] The brain then engages in further processing of these thoughts, integrating them with sensory input, emotional states, and memories. This processing, while rooted in the physical, navigates and influences the realm of the mental, reflecting the dual nature of human cognition as both a physical and a mental phenomenon.

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[60] Bernhard Kutzler, "Thoughts Are Not Products of the Brain – Mind Cafe – Medium," Medium, March 28, 2022, https://medium.com/mind-cafe/thoughts-are-not-products-of-the-brain-a488b6690c99.

[61] Ralph Lewis, "What Actually Is a Thought? And How Is Information Physical?," Psychology Today, October 2023, https://www.psychologytoday.com/us/blog/finding-purpose/201902/what-actually-is-a-thought-and-how-is-information-physical.

[62] Kanchan Roy, "A Discussion on Computational Functionalism of Mind," Www.Academia.Edu, November 3, 2018, https://www.academia.edu/37697725/A_discussion_on_Computational_Functiona lism_of_Mind.

[63] For example, a mental state like 'pain' is identified not by its neurophysiological features but by how it functions in the organism – its causes (like tissue damage), and its effects (like withdrawal from harm, distress, and pain behaviour), "Multiple Realizability, Mind and | Internet Encyclopedia of Philosophy," n.d., https://iep.utm.edu/mult-rea/.

The relevance of these findings in the context of BCI decoding is profound. The current state of neuroimaging and BCI technologies, as exemplified by studies like *Gallant* lab's fMRI-based image reconstruction[64] and *Moses* et al.'s ECoG-based speech dialogue decoding,[65] demonstrates significant progress in decoding the input and output signals of the brain. However, the true essence of 'thought' – what happens between these inputs and outputs – remains elusive. This gap in understanding underscores the challenges faced by BCI in accurately interpreting and translating the intricate workings of the human mind. The realization that thoughts are not entirely constructible from electrical activity alone suggests that BCI might need to evolve beyond current methodologies to fully capture and interact with human thought processes, grounding legal and ethical discussions regarding privacy and personal data protection.

3.1 Brain and Neuronal Information Converted into Personal Data

The GDPR, which came into effect on May 25, 2018, within the European Union, establishes a framework for the processing of personal data, 'in the context of the activities of an establishment in the EU regardless of whether the processing takes place in the Union or not',[66] under all the changes causes by the rapid development of technologies and globalisation.[67] It defines personal data as 'any information that

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[64] Kendrick Kay et al., "Identifying Natural Images from Human Brain Activity," Nature 452, no. 7185 (March 1, 2008): 352–55, https://doi.org/10.1038/nature06713.

[65] David A. Moses et al., "Real-Time Decoding of Question-and-Answer Speech Dialogue Using Human Cortical Activity," Nature Communications 10, no. 1 (July 30, 2019), https://doi.org/10.1038/s41467-019-10994-4.

[66] "Guidelines 3/2018 on the Territorial Scope of the GDPR (Article 3) – Version Adopted after Public Consultation | European Data Protection Board," n.d., https://edpb.europa.eu/our-work-tools/our-documents/guidelines/guidelines-32018-territorial-scope-gdpr-article-3-version_en.

[67] Recital 6 of the Official Journal of the European Union, "REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016 on the Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Movement of Such Data, and Repealing Directive 95/46/EC (General Data Protection Regulation)," 2016, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679.

relates to an identified or identifiable natural person',[68] being considered a "data subject". Personal data under the GDPR encompasses a wide range of information, including obvious subject identifiers such as names, identification numbers, and location data. It also covers less direct identifiers, like an online service provider that can be used to identify a person when combined with other information, such as the 'physical, physiological, genetic, mental, economic, cultural or social identity of that natural person'.[69] Despite these references to physical, physiological, and mental identifiers, the GDPR does not explicitly mention brain or neural information. This raises a critical question with regard to the applicability of the regulation with regard to brain information that it is not health data, nor stemming from medical devices.[70]

The neuron's ability to generate an action potential, electrical signal, and propagate it along the axon to the synapse, where it can trigger the release of neurotransmitters into the synaptic cleft, is fundamental to brain function. This synaptic transmission is the primary mechanism for neuron-to-neuron communication. The patterns and frequencies of these action potentials and the resulting neural networks they form are measured and considered as neural data.

The technical explanation of the neurotechnology applied in the scientific study already displayed, showed that the extrapolated information consists of two different components: (i) untouched physiological values that are manifested by the brain's electrical activity; (ii) the interpretation that experts make of the untouched values. These interpretations transform basic physiological measurements into crucial data that can be

[68] Article 4(1) of the GDPR defines personal data as "any information relating to an identified or identifiable natural person ('data subject'); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person."

[69] Ibid.

[70] Stephen Rainey et al. (n 27), page 17.

concerned to an individual's health status or, based on the particular brain regions analysed, their racial and ethnic[71] background. As such, ECoG signals, just like EEG signals, have no meaning in themselves; they need to be read and decoded in order to be translated into meaningful information about the individual. To utilize brain recordings effectively, it is necessary to isolate signals pertinent to a specific objective from the overall recorded data, which means, to render brain recordings practical for a specific use, undergoing the processing of key features that are extracted and relevant signals categorized based on identifiable characteristics of a certain brain activity that is converted to digital data.

To understand what sets brain information apart as a distinct category of personal data, it's essential first to examine if data derived from the human brain through the neurotechnologies fits within the EU's data protection legal framework's definition of personal data. The author Dara Hallinan and his colleagues have previously addressed this question under the Data Protection Directive[72] (DPD), analysing it as the term "neurodata". Given the DPD's broad scope, their conclusion was that neural data falls under the umbrella of personal data.[73] This broad approach in data protection law is intentional, designed to ensure robust protection of individual rights.[74] Consequently, the term "personal data" in EU law is interpreted expansively, covering almost any data linked to an identifiable individual.[75] The development of the right to data

[71] Peipeng Liang et al., "Construction of Brain Atlases Based on a Multi-Center MRI Dataset of 2020 Chinese Adults," Scientific Reports 5, no. 1 (December 18, 2015), https://doi.org/10.1038/srep18216.

[72] Official Journal of the European Communities, "Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the Protection of Individuals with Regard to the Processing of Personal Data and on the Free Movement of Such Data," 1995, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31995L0046.

[73] Dara Hallinan et al., "Neurodata and Neuroprivacy: Data Protection Outdated?," Surveillance and Society 12, no. 1 (November 20, 2013): 55–72, https://doi.org/10.24908/ss.v12i1.4500.

[74] Nadezhda Purtova, "The Law of Everything. Broad Concept of Personal Data and Future of EU Data Protection Law," Law, Innovation and Technology 10, no. 1 (January 2, 2018): 40–81, https://doi.org/10.1080/17579961.2018.1452176.

[75] ARTICLE 29 DATA PROTECTION WORKING PARTY, "Opinion 4/2007 on the Concept of Personal Data," June 2007, https://www.clinicalstudydatarequest.com/Documents/Privacy-European-guidance.pdf.

protection, culminating in the adoption of the GDPR, has largely been driven by the need to align legal tools with societal and technological advancements. As a result, the scope of EU data protection law has expanded.[76] By applying this rationale to brain data under GDPR, which has an even wider scope than the DPD, the same conclusion emerges.

While there is not an agreed definition of neural data, which is also referred as brain data,[77] the UNESCO International Bioethics Committee Report on Neurotechnology utilizes the term to describe it as 'personal brain data', [78] while the Council of Europe's Bioethics Committee identifies it as 'human brain data'.[79] Pursuant, also, to the Organisation for Economic Co-operation and Development understanding[80], personal brain or neural data are 'data relating to the functioning or structure of the human brain of an identified or identifiable individual that includes unique information about their physiology, health, or mental states'.[81] As for the Information Commissioner's Office is concerned, the concept of neural data is extended not only to information collected from the brain, but also from the nervous system, defining it as 'first order data gathered directly from a person's neural systems (inclusive of both the brain and the nervous systems) and second order inferences based directly upon this data'.[82]

In our opinion, in the balance of the two definitions identified

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[76] See Recital 6 of the GDPR.

[77] Information Commissioner's Office, "ICO Tech Futures: Neurotechnology," June 2023, https://ico.org.uk/media/about-the-ico/research-and-reports/ico-tech-futures-neurotechnology-0-1.pdf.

[78] Report of the International Bioethics Committee of UNESCO (n 14).

[79] See Report commissioned by the Committee on Bioethics (DH-BIO) of the Council of Europe (n 10), page 23: "These quantitative data about the structure, activity and function of the human brain can be called 'human brain data'. Human brain data can reveal information about a person health status (e.g., neurological, or psychiatric health) and, to some extent, support inferences about mental processes".

[80] Hermann Garden et al., "Responsible Innovation in Neurotechnology Enterprises," OECD Science, Technology and Industry Working Papers, October 11, 2019, https://doi.org/10.1787/9685e4fd-en.

[81] "OECD Legal Instruments," n.d., https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0457.

[82] Information Commissioner's Office (n 77).

above, the concept of neural data used by the ICO is more complete, largely sufficient for the protection of the intended personal data of the subjects, with regard to the range of personal data involved in the brain, but it is also the most applicable to the reality in question. The definition given by UNESCO does not castrate other personal data that can be obtained by the brain, but it does imply that the data that can be obtained comes from physiological or health data. The problem actually lies in the consideration of "mental states"[83] as brain/neural data, when these states are more appropriately inferred from the mind, being referred to a range of cognitive conditions and processes, but not exclusively, as will be seen further ahead. Brain data processing involves various methods, including adaptive, unsupervised processes, where purpose-specific information is extracted from general brain activity recordings, which comes from brain states. This processing can yield diverse information from the same recording for different purposes, and adaptive filtering and classifying may evolve, potentially revealing more or different information than initially intended by researchers or users, opening a window to the potential of brain recordings to predict user behaviour, brain states, and identity-related activities[84] that needs data protection and privacy scrutiny, leading to increasing calls for international regulation as consumer neurotechnology gains broader market entry.[85]

Effectively, brain data gives us insight into the macro-level activities and states of the brain, but also draws us into the micro-level, revealing the intricacies of how neurons communicate and function, offering a detailed lexicon of the brain's language encoded in action potentials and synaptic transmissions, through the neural system,

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[83] "We define 'mental state' any conglomeration of mental representations and propositional attitudes that corresponds to the experience of thinking, remembering, planning, perceiving, and feeling" in Marcello Ienca and Gianclaudio Malgieri (n 22).

[84] Philipp Kellmeyer, "Big Brain Data: On the Responsible Use of Brain Data from Clinical and Consumer-Directed Neurotechnological Devices," Neuroethics 14, no. 1 (May 19, 2018): 83–98, https://doi.org/10.1007/s12152-018-9371-x.

[85] Marcello Ienca, Pim Haselager, Ezekiel Emanuel (n 22).

acting as the granular manifestation of the brain's activity, capturing the bioelectrical and biochemical phenomena that constitute the essence of neural processing. To sum it up, brain data are the first order data gathered directly from a person's neural system, inclusive of both the brain and the nervous system and second order inferences based directly upon this data.

But what has been shown is that, regardless of the definition that can be attributed to neural data, it is not sufficient to correspond with data that comes from a combination of various internal factors that interrelate the neuronal connections with phenomenon that are rooted in the brain's neural processes, experienced and interpreted through the lens of psychological processes, and ultimately originate in the mind's complex, abstract realm, like thoughts.

2.2 Deciphering Thoughts: Distinguishing Mental Data from Brain Data collected by "Mind-Reading" BCI Technology

The UNESCO's report of the International Bioethics Committee, published in 2021, states that 'the specificity of brain data lies in the inferences that can be drawn from their analysis about actual consciousness, emotional state or even thoughts'.[86] What actually transpires from this statement is that the brain data comes from the information obtained through an analysis not only of consciousness and emotional state, but also through thoughts, necessarily making the brain data later than the true core of the information, creating the possibility of being accused that thoughts represent a distinct type of data surpassing traditional brain data or the neural system claimed by the ICO report.

'The term "mind-reading" has been used to describe the mechanisms employed by BCI and neural decoding using neurotechnologies.'[87]

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[86] Report of the International Bioethics Committee of UNESCO (n 14) page 36.

[87] Stephen Rainey et al., "Brain Recording, Mind-Reading, and Neurotechnology: Ethical Issues from Consumer Devices to Brain-Based Speech Decoding," Science and Engineering Ethics 26, no. 4 (April 30, 2020): 2295–2311, https://doi.org/10.1007/s11948-020-00218-0.

BCI can decode neural activity associated with specific mental states or intentions, such as imagined speech or movement intentions. This procedure has been popularized as "mind-reading"[88], but it generally just entails the creation of dependable statistical correlations between brain activity, function, structure, and mental information, such decoding is based on identifying patterns in brain activity and is not equivalent to accessing or "reading" the full complexity of thoughts, manifesting itself in the translation of specific brain signals into actionable results rather than understanding their subjective and nuanced content.

Mind-reading surpasses the brain data to be interpreted by the BCI.[89] Considering the scientific study presented, as well as others, but with less positive results,[90] a speech decoder Brain-Computer Interface focus specifically on interpreting the neural mechanisms associated with speech production. These BCI utilize advanced algorithms to analyse patterns of brain activity, particularly those that occur during speech or speech-related processes. The technology effectively maps these neural patterns to corresponding speech sounds or textual representations. However, it does not delve into the personal, subjective content of thoughts or emotions, but they consist in educated guesses based on data patterns; BCI rely on pattern recognition technologies that associate specific neural activity patterns with predefined outcomes or commands. The capability of these systems is grounded in the physical realm of brain activity, translating specific neural signals into speech or text based on probabilistic models that are limited to the scope defined by the training data, and not in interpreting or 'reading' the abstract, if

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[88] Matthias Gamer, "Mind Reading Using Neuroimaging," European Psychologist 19, no. 3 (January 1, 2014): 172–83, https://doi.org/10.1027/1016-9040/a000193.

[89] Kathinka Evers and Mariano Sigman, "Possibilities and Limits of Mind-Reading: A Neurophilosophical Perspective," Consciousness and Cognition 22, no. 3 (September 1, 2013): 887–97, https://doi.org/10.1016/j.concog.2013.05.011.

[90] Brumberg, "Classification of Intended Phoneme Production from Chronic Intracortical Microelectrode Recordings in Speech-Motor Cortex," Frontiers in Neuroscience, May 12, 2011, https://doi.org/10.3389/fnins.2011.00065; Stéphanie Martin et al., "Word Pair Classification during Imagined Speech Using Direct Brain Recordings," Scientific Reports 6, no. 1 (May 11, 2016), https://doi.org/10.1038/srep25803.

there is such a thing, subjective nature of individual thoughts or internal mental states, which proves the point, for now, that the technology still available is unable to gauge information directly from thoughts, unless scientifical evolution proceeds to "bless" us with a Mind--Computer Interface.

Ienca and Malgieri define Mental Data as 'any data that can be organized and processed to infer the mental states of a person, including their cognitive, affective, and conative states'.[91] Furthermore, mental representations are the closest psychological and neurobiological substrate for fundamental ethical-legal notions such as freedom of thought, personal identity, personal autonomy, mental integrity and others.[92] Thoughts, as part of mental representations, form an integral part of an individual's psychological makeup and are essential to their sense of self and autonomy. Therefore, thoughts as Mental Data are not only central to cognitive processes but are also fundamental to the core aspects of safeguarding human rights and personal freedom.

Additionally, this complexity and depth might position thoughts as a unique category of data inserted in Mental Data, with implications that extend beyond the physiological or structural aspects typically associated with brain data, considering that (i) Mental Data is not brain data, since information about mental states and processes can be inferred from non-neural data, such as behavioural data; and (ii) not all brain data is Mental Data, since brain data can be processed to infer not only mental states, but also the basic anatomy and physiology of the brain, without revealing anything related to mental states and processes.[93]

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[91] Marcello Ienca and Gianclaudio Malgieri (n 22), page 4.

[92] Caplan A. L. (2017). Joseph J. Fins' Rights Come to Mind: Brain Injury, Ethics and the Struggle for Consciousness. Cerebrum: Orsolya Friedrich et al., "An Analysis of the Impact of Brain-Computer Interfaces on Autonomy," Neuroethics 14, no. 1 (April 18, 2018): 17–29, https://doi.org/10.1007/s12152-018-9364-9.

[93] Marcello Ienca and Gianclaudio Malgieri (n 22), page 7.

2.3 Thoughts as Personal Data under GDPR

Returning to the concept of personal data under the GDPR,[94] it can be divided into four cumulative requirements: (i) 'any information'; (ii) 'relating to'; (iii) 'an identified or identifiable'; (iv) 'individual'. In order to understand whether thoughts can be personal data under the Regulation, let's take a closer look at the fulfilment of the requirements.

The concept of 'personal data' under GDPR is intentionally broad, encompassing 'any information' even seemingly trivial data.[95] Personal data includes both objective and subjective information, in form of opinions for example,[96] whether it concerns private life, professional activities, or social behaviour, and does not need to be true, proven, or complete,[97] as long as it is related to a person. This definition covers all forms of data, regardless of medium, adhering to a technology-neutral approach, safeguarding all data types, ensuring robust privacy rights. Considering the fact that the GDPR is prepared to include information that is considered subjective, it is not opposed to considering the nature of thoughts as a statement about any person which takes the form of reading and interpreting information.

The European Regulation requires that information must pertain – 'relating to' – to an individual to be considered personal data. The CJEU, guided by WP29,[98] states that the information's content, purpose, or effect must be linked to a specific person,[99] i.e., if it directly concerns the particular individual or allows inferences about them, like wealth

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[94] Article 4(1) of the GDPR (n 65).

[95] COMMISSION OF THE EUROPEAN COMMUNITIES, "COM(90) 314 Final – SYN 287 and 288 Brussels," September 1990, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:51990DC0314.

[96] ARTICLE 29 DATA PROTECTION WORKING PARTY (n 70), page 6.

[97] Ibid.

[98] Ibid, page 10.

[99] Judgment Of The Court (Second Chamber), Case C434/16, Peter Nowak v Data Protection Commissioner, 2016. Available at: https://curia.europa.eu/juris/document/document.jsf?text=&doc_id=198059&pageIndex=0&doclang=en&mode=lst&dir=&occ=first&part=1&cid=1067970.

from property value or driving behaviour from car service records.[100]Central to the application of personal data is the capacity to identify directly or indirectly, the data subject, a concept known as linkability.[101] When defining the scope of personal data and assessing linkability, there is scholarly debate over the use of 'objective' versus 'relative' criteria.[102] When considering the protection of thoughts as personal data, the abstract theory, or objective criterion, emerges as the more suitable approach. This theory advocates that personal data encompasses all information potentially linkable to an individual, independent of the particular context or the specific knowledge of the data processor or controller.[103] Such an inclusive definition is crucial for thoughts, given their deeply personal and intricate nature. Thoughts encapsulate a person's innermost experiences and ideas, which, if not broadly protected, could be vulnerable to misuse or exploitation. The concrete theory, or relative criterion, in comparison, bases personal data designation on the ability of a specific actor to associate the data with an individual in given circumstances.[104] This narrower view could lead to inconsistent protection of thoughts, as it hinges on the varying capabilities and resources of different data processors. By adopting the abstract theory, a more uniform and expansive safeguard is provided, ensuring that thoughts are consistently recognized and protected, thus minimizing their potential exploitation for economic or other purposes.

Identification of a data subject, a key GDPR component, hinges on whether the person is 'identified or identifiable.' Identification occurs through unique characteristics like name, location, or physical traits, not necessarily requiring a person's name, as other identifiers may be

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[100] ARTICLE 29 DATA PROTECTION WORKING PARTY (n 70), page 10.

[101] Judgment of the Court (Second Chamber), "Peter Nowak v Data Protection Commissioner in Case C-434/16," (n 27), [61]-[63].

[102] JUDGMENT OF THE COURT (Second Chamber), "Patrick Breyer v Bundesrepublik Deutschland in Case C-582/14 (n 26).

[103] Oskar Josef Gstrein, "Mobile Devices as Stigmatizing Security Sensors: The GDPR and a Future of Crowdsourced 'Broken Windows,'" 2018, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3105228.

[104] Ibid.

more distinctive.[105] Identifiability involves potential identification through information combinations.[106] This assessment considers various factors like technology and resource availability, emphasizing the realistic likelihood of identification rather than mere hypothetical possibilities. For instance, in the Breyer v Germany case, mentioned on the footnotes, the CJEU deliberated on IP addresses as personal data, illustrating how context influences data classification. This ruling suggests that dynamic IP addresses can be personal data when additional details enable individual identification.[107] This case extends beyond IP addresses, potentially widening the scope of data needing protection. The focus on the possibility, not the probability, of identification implies that data types like identifiers in neurotechnology, unless entirely anonymized, might be deemed personal data under GDPR, as anonymization would negate the functional purpose of consumer neurotechnology devices.[108] Based on this ruling it's plausible to argue that thoughts could be identified or identifiable with the data subject. If thoughts, as interpreted by neurotechnology, can be combined with other information that identifies the specific individual, creating an inter dependency and connecting between the data subject and the technology. This aligns with the CJEU's emphasis on the potential for identification, rather than the direct identification, broadening the scope of what may be categorized as personal data. For example, if a brain recording device is designed to respond to unique brain signals of a user for device control, it needs to be specifically calibrated for that individual.[109] The device's classification or filtering algorithms will then function in a manner tailored to the user's distinct brain patterns. In such cases, the use of these

[105] See ARTICLE 29 DATA PROTECTION WORKING PARTY (n 70), page 12.

[106] Ibid.

[107] JUDGMENT OF THE COURT (Second Chamber), "Patrick Breyer v Bundesrepublik Deutschland in Case C-582/14" (n 26), [49].

[108] Stephen Rainey et al. (n 27), page 7.

[109] Dennis J. McFarland and Jonathan R. Wolpaw, "Brain–Computer Interface Use Is a Skill That User and System Acquire Together," PLOS Biology 16, no. 7 (July 2, 2018): e2006719, https://doi.org/10.1371/journal.pbio.2006719.

calibrated algorithms creates a direct link between the data set and the specific user, allowing a data controller to associate the algorithm's operation with the individual data subject. Extending this logic to thoughts, if such devices can interpret and respond to individual thought patterns, then brain signals, could potentially be linked to a specific user. This implies that in certain contexts, thoughts can be identifiable and thus may fall under the scope of personal data as defined by GDPR.

The right to data protection under Article 8 of the EU Charter of Fundamental Rights[110] applies to all natural persons, not limited by nationality. This protection typically extends from birth until death,[111] with deceased persons' data generally not considered personal.[112] However, member states may enact rules to protect deceased persons' data, and genetic data may indirectly receive protection through relatives. Information on legal entities is usually not personal data,[113] but exceptions exist, especially when such data can reveal details about natural persons, like in small or family-run businesses, where company information might relate to an individual. The factor of a natural person being central to the definition of personal data under GDPR directly applies to thoughts as personal data. Since thoughts are inherently personal and originate from natural persons, they align with the GDPR's protection scope. This implies that any data, including thoughts, generated, processed, or inferred from a natural person's brain activity falls under the umbrella of personal data protection, provided it relates to an identifiable individual.

Under Article 4(1) of the GDPR thoughts inherently meet these requirements, as they provide information which is unique to individuals and can be linked to them, either directly or indirectly through neurotechnology. Thoughts reflect personal experiences, preferences,

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[110] United Nations, "Universal Declaration of Human Rights | United Nations," n.d., https://www.un.org/en/about-us/universal-declaration-of-human-rights.

[111] ARTICLE 29 DATA PROTECTION WORKING PARTY (n 70), page 23.

[112] See Recital 27 of the GDPR (n 65).

[113] Ibid, Recital 14.

and emotions, making them distinctive to each person. Therefore, when captured, interpreted, or processed through technologies like BCI, thoughts can be considered personal data as they provide identifiable information about a natural person, aligning with the GDPR's definition and scope. 'What remains is a discussion of how significant this data may be, how existing regulations ought to be interpreted, and what further regulation may be required'.[114] It could be argued that a thought does not necessarily result in information that identifies, directly or indirectly, the data subject, but in fact the reasoning done would only result in an *a posteriori* consequence of the thought, because, as already discussed, thought is what lies in the middle between the input, the neuronal mechanism that reacts to the stimulus of individual experience, and the output, which manifests itself in the reading and interpretation of the information collected from the brain signals, as such, thought always comes from a singular procedure that uniquely identifies the individual, that is, personal data of the data subject. Furthermore, if it is proven that brain patterns captured through EEG or fMRI provide unique and personalised information about the individual,[115] and these are the result of a set of factors in the consequential interrelationship between the mind and the brain, then thoughts are also personal and identify the person.

After understanding that thoughts are Mental Data that fall within the scope of the GDPR, it is important to determine if it has any additional protection under a special category of personal data.

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[114] Stephen Rainey et al. (n 27), page 9.

[115] "Are Your Thoughts Your Own?:"Neuroprivacy" and the Legal Implications of Brain Imaging," Member & Career Services | NYC Bar, n.d., https://www.nycbar.org/member-and-career-services/committees/reports-listing/reports/detail/are-your-thoughts-your-ownneuroprivacy-and-the-legal-implications-of-brain-imaging.

3. Mental Data as a limit of the scope of sensitive data processing: CJEU Decision C-184/20

The next legal issue to consider is whether data related to the human mind can be classified as special categories of personal data. While the GDPR uses the term "special categories of personal data" to refer to what is commonly known as "sensitive data", it does not explicitly define sensitive data as a separate concept, instead this term is often used in broader discussions about data privacy to refer to any that that could cause harm to an individual if disclosed or misused, which includes but is not limited to the special categories of personal data defined by the GDPR. The user's privacy concerns and their willingness to disclose information are affected by the perceived sensitivity of that information and the advancements of technology entail the continuous creating of enormous amounts of personal data.[116] The GDPR defines sensitive data in the recital (51):

> *"Personal data which are, by their nature, particularly sensitive in relation to fundamental rights and freedoms merit specific protection as the context of their processing could create significant risks to the fundamental rights and freedoms".*[117]

However, various other factors also contribute to how users perceive the sensitivity of data. These include the perceived risk, potential for harm, and the public availability of the data, all of which can influence the perception of information as being sensitive.[118] The existing

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[116] Paul Quinn, "The Anonymisation of Research Data – A Pyric Victory for Privacy That Should Not Be Pushed Too Hard by the Eu Data Protection Framework?," European Journal of Health Law 24, no. 4 (October 19, 2017): 347–67, https://doi.org/10.1163/15718093-12341416.

[117] GDPR (n 65).

[118] John Rumbold and Barbara K. Pierscionek, "What Are Data? A Categorization of the Data Sensitivity Spectrum," Big Data Research 12 (July 1, 2018): 49–59, https://doi.org/10.1016/j.bdr.2017.11.001.

EU data protection framework, particularly the GDPR, has specific measures designed to offer enhanced protection for such special categories of personal data. These categories, due to their inherent nature, can significantly impact individuals' lives when processed,[119] and thus the GDPR ensures they receive additional safeguards, consequently the processing of sensitive data is permissible only under certain conditions and with the implementation of specific protective measures.[120] Accordingly to the article 9 (1) of the GDPR, special categories of data, also known as sensitive data, encompass information revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, also including genetic data, biometric data for uniquely identifying a person, health-related data, and data concerning a person's sex life or sexual orientation. [121] 'The data related to the brain, despite all the peculiarities and related risks previously highlighted, are not explicitly mentioned within them'.[122]

It is known that information that can reveal a condition of pathological mental status is sensitive data, because it is associated with health data. Article 4(15) of the GDPR defines this type of data as 'personal data related to the physical or mental health of a natural person, including the provision of health care services, which reveal information about his or her health status',[123] being further developed in recital 35 that 'all data pertaining to the health status of a data

[119] "The rationale behind regulating particular categories of data in a different way stems from the presumption that misuse of these data could have more severe consequences on the individual's fundamental rights, such as the right to privacy and non-discrimination, than misuse of other, "normal" personal data" in ARTICLE 29 DATA PROTECTION WORKING PARTY, "Advice Paper on Special Categories of Data ('Sensitive Data')," April 2011, https://ec.europa.eu/justice/article-29/documentation/other-document/files/2011/2011_04_20_letter_artwp_mme_le_bail_directive_9546ec_annex1_en.pdf.

[120] Ibid.

[121] GDPR (n 65).

[122] Sara Latini, "To the Edge of Data Protection: How Brain Information Can Push the Boundaries of Sensitivity A Doctrinal Legal Analysis of EEG and fMRI Neurotechnologies under EU Data Protection Law" (MA thesis, 2018), page 38.

[123] GDPR (n 65).

subject which reveal information relating to the past, current or future physical or mental health status of the data subject'.[124] This definition, generally associated with 'mental health status,' encompasses not just pathological conditions but also the physiological state indicating the absence of mental pathology. Thus, biological parameters typically used to identify mental illnesses qualify as sensitive data even when indicating normal brain function, implying that the concept of mental health should be broadly interpreted to include various cognitive processes and emotional states of an individual.[125] The analysis becomes much more complicated if the information collected does not directly or indirectly reveal non-physiological conditions such as information related to emotions and thoughts, however if these types of data are collected using emotion detection tools that employ biometric methods, like facial recognition technology,[126] a correlation is established with biometric data which is considered sensitive personal data for the GDPR.

So, what I can identify after these considerations is that the regime for considering data as sensitive is too restricted considering current technological advances, and for some authors,[127] data that reveals information about the holder's thoughts is not necessarily sensitive, just because it only refers to the subject's mental sphere, but taking into account the content, context and purpose of the data processing,[128] it is possible that these types of data could reveal information about the sensitive data[129] contained in Article 9(1) of the GDPR. Considering these insights, it's evident that there is a distinct conceptual and normative gap: despite a public consensus on the intimate and sensitive nature of

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[124] Ibid.

[125] In this path see Giovanni Comandé and Giulia Schneider, "Regulatory Challenges of Data Mining Practices: The Case of the Never-Ending Lifecycles of 'Health Data,'" European Journal of Health Law 25, no. 3 (April 18, 2018): 284–307, https://doi.org/10.1163/15718093-12520368.

[126] Damian Clifford, "Citizen-Consumers in a Personalised Galaxy: Emotion Influenced Decision-Making, a True Path to the Dark Side?," Social Science Research Network, January 1, 2017, https://doi.org/10.2139/ssrn.3037425.

[127] Marcello Ienca and Gianclaudio Malgieri (n 22), page 10.

[128] Paul Quinn and Gianclaudio Malgieri (n 26).

[129] Stephen Rainey et al. (n 27), page 11.

Mental Data, not all such data are safeguarded under the strict provisions of the GDPR for sensitive data. Furthermore, a thorough assessment of the sensitive nature of Mental Data requires an examination of their inherent qualities and potential, especially when integrated with advanced interpretative methods and technologies. This analysis extends beyond the conventional scope, pushing the boundaries of GDPR's traditional definition of sensitivity to potentially encompass Mental Data as well, and for this it is necessary to analyse the case C-184/20 of the Court of Justice of the European Union decision that opens the scope of sensitive personal data under the GDPR.

3.1 CJEU Case C-184/20 – Concept of Sensitive Data widened *de jure* and *de facto*

The Court of Justice of the European Union case C-184/20 addresses several significant issues related to the processing of personal data under the GDPR, specifically focusing on the concept of sensitive data. The case arose from proceedings between an individual, OT, and the Chief Official Ethics Commission in Lithuania, concerning OT's failure to lodge a declaration of private interests,[130] declaration aimed at fighting corruption and ensuring good government,[131] as administrator of a company that received EU funding, prompting legal proceedings that questioned the intersection of national data processing requirements with the broader scope of the GDPR and the Charter of Fundamental Rights of the European Union. The CJEU's position may be understood as resolving the disagreement between Norway's Data Protection Authority, which advocated for a broad interpretation of "special

[130] Judgment of the Court (Grand Chamber), "Vilniaus Apygardos Administracinis Teismas – Lithuania) – OT v Vyriausioji Tarnybinės Etikos Komisija in Case C-184/20," August 2022, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:62020CA0184&from=EN.

[131] Aly Marczynski José María Marín, "Compendium of Good Practices on Anti-Corruption for OGP Action Plans," December 18, 2018, https://apo.org.au/node/252866.

categories of personal data" in the Grindr case,[132] and Spain's Data Protection Agency, which conversely determined that no special category of personal data was processed in the identical context.[133]

The disclosure of personal data through declarations of private interests could potentially infringe upon individuals' rights to privacy. Such disclosures might inadvertently reveal sensitive information about a person's living arrangements, sexual orientation, and intimate family and personal relationships. This aspect of the case highlighted the sensitive nature of the data in question and the need for careful legal scrutiny in its handling. At the heart of the CJEU's analysis were two questions for the court to answer and decide: (i) To what extent could the online publication of the OT's declaration of private interests be based on Article 6(1) and (3) of the GDPR as a valid legal basis for data processing;[134] (ii) the publication of the name of the OT partner may or may not be processed in accordance with the limits and conditions set out in Article 9(1) and 9(2)(g) of the GDPR.[135] Restricting the court's good decision to the analysis in this thesis, let's just look at the scope of the second issue.

In addressing the second question, the CJEU's examination centres on data that, while not categorically classified as 'sensitive' under Article 9 of the GDPR, nonetheless carry the potential to disclose sensitive information, like sexual orientation. The Court scrutinized the nature of data specifically related to the spouse, cohabitee, or partner of the declarant.[136] It was noted that such data could inadvertently expose details about the individual's sex life or sexual orientation, as well as that of their partner.[137] To arrive at such sensitive revelations, the Court

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[132] "Grindr Has Appealed the Administrative Fine Imposed by the NO DPA," Datatilsynet, n.d., https://www.datatilsynet.no/en/news/aktuelle-nyheter-2022/datatilsynet-har-mottatt-klage-pa-overtredelsesgebyr-i-grindr-saken/.

[133] "AEPD (Spain) – E/03624/2021," GDPRhub, n.d., https://gdprhub.eu/index.php?title=AEPD_(Spain)_-_E/03624/2021.

[134] JUDGMENT OF THE COURT (Grand Chamber), Case C184/20 (n 129), [60].

[135] Ibid [117].

[136] Ibid [119].

[137] Ibid [118,119].

highlighted the necessity of an "intellectual operation involving comparison or deduction".[138] This process is identified as a key criterion for applying the heightened protection regime, typically reserved for inherently sensitive data, to personal data that are not inherently sensitive but have the potential to reveal sensitive aspects of an individual's private life.

Unfortunately, the Court does not discuss any further how this "intellectual operation involving comparison or deduction" should be conducted, whether certain criteria should be considered or whether it could be merely – and legitimately – based on stereotypes and common sense.[139] The Court's rationale is primarily based on ensuring consistency in interpreting the provisions related to sensitive data. It also emphasizes the importance of upholding a high standard of data protection, particularly concerning certain facets of private life.[140] This concept of intellectual operation is instrumental in evaluating how data is handled, focusing on whether the processing involves complex mental tasks such as comparing or deducing information from the available data.

The Court takes a contextual approach[141] in its analysis but stops short of detailing the specific criteria for identifying potentially sensitive personal data. Instead of relying solely on this contextual method, the Court could have benefited from a more nuanced approach, incorporating elements of a purpose-based analysis. It would have been pertinent for the Court to acknowledge that the administrative authority in question did not aim, either directly or indirectly, to gather information about the sexual orientation of individuals under transparency obligations. 'Moreover, the Court does not provide a taxonomy of personal data, either concerning the same data subject or third parties,

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[138] Ibid [120].

[139] Giacomo Delinavelli, "Comment to Case C-184/20 and the Perils of a Broad Interpretation of Art. 9 GDPR," European Law Blog, September 21, 2022, https://europeanlawblog.eu/2022/09/21/comment-to-case-c-184-20-and-the-perils-of-a-broad-interpretation-of-art-9-gdpr/.

[140] JUDGMENT OF THE COURT (Grand Chamber), Case C184/20 (n 130), [125,126].

[141] Ibid [124].

that combined among them would reveal sensitive information', undermining legal certainty to data controllers.[142]

As a result of the evolving legal and practical understanding of sensitive data, heightened by advancements on the Internet of Things and increasing interconnectivity, there is a growing likelihood that more personal data will be classified as sensitive.[143]

3.2 Expanding Sensitivity to Mental Data

'If it is possible to indirectly deduce sensitive characteristics about a person from a reading of other personal data, the personal data in question will qualify as special category data – and no amount of risk mitigation measures to that data can remove its classification as special category data'.[144] The CJEU's interpretation of the "intellectual operation of comparison or deduction" provides an essential framework for the possibility of extending the concept of sensitive data to cover Mental Data, and therefore thoughts, suggesting that the process of inferring sensitive information from data involves intellectual operations like comparison or deduction. When applied to thoughts as Mental Data, this implies that the analysis or processing of such data to infer personal information, such as emotional states, intentions, or preferences, would require a similar level of intellectual operation, involving the possibility to deduce personal characteristics or predispositions from the patterns or nature of an individual's thoughts.

The CJEU's broad interpretation of special categories of data in this judgment establishes a high threshold that, in practice, may prove challenging to effectively manage. Regardless of the rationality of the

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[142] Giacomo Delinavelli (n 139).

[143] Michela Galea, "CJEU Widens the Scope of Sensitive Personal Data under the GDPR," Data Protection – Worldwide, October 4, 2022, https://www.mondaq.com/data-protection/1236466/cjeu-widens-the-scope-of-sensitive-personal-data-under-the-gdpr.

[144] Andre Walter, "EU Court: Data Attributes Revealing Sensitive Personal Data Can Be 'Special Category' Data," Pinsent Masons, August 5, 2022, https://www.pinsentmasons.com/out-law/news/eu-court-data-attributes-sensitive-personal-data-special-category.

approach taken by the CJEU, what I can deduce regarding the perception of sensitive data is that it is necessary to analyse whether the data in question can, underlining can, reveal information related to the sensitive data listed in Article 9(1) of the GDPR by means of an intellectual operation involving comparison, inference, or deduction. Considering the great possibility of Mental Data being able to reveal the thoughts of each individual with regard to any sensitive personal data contained in the last rule invoked, I can say that, through an intellectual operation where the level of protection of Mental Data is compared with some sensitive data, the great possibility of their protection being equal to that of sensitive data is inferred and deduced, because otherwise it would result in distinctions being drawn according to the type of sensitive data at issue, thus diminishing the standard of protection which is intended to be afforded to special categories of personal data.

The following question could arise from the possibility of neurotechnology being able to decode thoughts and then realise, if it is possible by advanced technological capabilities for accurately processing and interpreting Mental Data, that if they can isolate thoughts referring to personal data and sensitive personal data, then humans would have thoughts, or Mental Data, with a sensitive nature and others not? I do not consider that this distinction would be positive for the data subject. Considering the actual complex, dynamic, deeply subjective and fluid nature of thoughts,[145][146] making such a differentiation would not consider the constantly evolving and interweaving connections of thought, so it would complicate even more any attempt to categorize them rigidly. Furthermore, the current state of technology, even with advanced data processing and AI, is not sufficiently developed to distinguish between sensitive and non-sensitive thoughts accurately and reliably, creating a significant risk of

[145] John Paul Minda, "The Fluidity of Thought," John Paul Minda, PhD, June 11, 2018, https://jpminda.com/2018/06/11/the-fluidity-of-thought/.

[146] "Fluid Intelligence: Definition, Examples, & Psychology," The Berkeley Well-Being Institute, n.d., https://www.berkeleywellbeing.com/fluid-intelligence.html.

misinterpretation and error, which could lead to inappropriate processing of sensitive data.

A challenging scenario also arises as to the legal basis for processing this type of data. Before processing a special category data, controllers must fulfil certain requirements that exceed the standards for processing "ordinary" personal data. This includes identifying a lawful basis as per Article 6 of the GDPR and satisfying an additional condition for processing under Article 9 of the GDPR, but also following specified, explicit and legitimate purposes.[147] When it comes to the "indirect" processing of the special category data, organizations might often need to seek explicit, informed and free consent of the data subject. This necessity arises because explicit consent is frequently the only applicable legal basis under Article 9(2) of the GDPR, mainly when the processing of these type of data has a commercial nature. [148]

When the processing of Mental Data serves not just the commercial goals of the data controller but also aligns with the personal interests of the data subjects (such as self-monitoring, self-quantification, mental activity exploration, or cognitive training), the likelihood increases that the data subjects' consent is given freely, therefore valid.[149] However, research has shown that the collection and processing of information data from neurotechnology and digital phenotyping applications often takes place under weak consent regimes,[150] this is due to the fact that the Terms of Service of these digital tools are (i) rarely read by users, (ii) typically uninformative about the whole data lifecycle and the specifics of data processing, and (iii) often based on presumed consent rather than affirmative consent.[151] Taking into account that neurotechnology is able to access both conscious and subconscious brain processes, individuals that, for example, participate in neuroimaging

[147] GDPR (n 65), article 5(1)(b).
[148] Ibid, page 11.
[149] Marcello Ienca and Gianclaudio Malgieri (n 22), page 12.
[150] Marcello Ienca, Pim Haselager, Ezekiel Emanuel (n 22).
[151] Marcello Ienca and Gianclaudio Malgieri (n 22), page 12

studies, might unknowingly provide access to data that would not want to share with third parties. This leaves the question if the modern society should consider acceptable to consent for the collection of Mental Data that the individual is unaware of.

The processing of Mental Data is not limited to commercial purposes; it also encompasses non-commercial scenarios such as medical diagnosis, scientific research, or activities in the public interest. For example, when Mental Data is processed for healthcare purposes, like diagnosis or therapy, article 9(2)(h) of the GDPR permits such processing without the need for specific additional condition.[152] In the context of processing Mental Data for scientific research, Article 9(2)(j) of the GDPR permits such activities, provided they adhere to specific conditions. This includes the requirement for authorization under a Union or Member State law, ensuring proportionality to the research aim, respecting the right to data protection, and implementing measures to protect the fundamental rights and interests of the data subjects. The appropriateness of such intrusive research, particularly when it delves into the mental sphere of subjects, is subject to scrutiny.

However, the European Data Protection Supervisor in a preliminary opinion on scientific research, expressed that behavioural experiments generally fall outside the scope of the research exemption in Article 9(2)(j) of the GDPR.[153] This is because they often lack an established ethical framework to justify their proportionality under the GDPR. In essence, the social and scientific benefits are often outweighed by the potential infringement on the privacy and data protection rights of the research subjects.[154] The applicability of this statement to

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[152] Giulia Schneider, "OUP Accepted Manuscript," International Data Privacy Law, January 1, 2019, https://doi.org/10.1093/idpl/ipz015 in Marcello Ienca and Gianclaudio Malgieri (n 22), page 11.

[153] "Preliminary Opinion on Data Protection and Scientific Research," European Data Protection Supervisor, January 25, 2024, https://edps.europa.eu/data-protection/our-work/publications/opinions/preliminary-opinion-data-protection-and-scientific_en.

[154] Mason Marks, "Artificial Intelligence-Based Suicide Prediction," Scholarship Repository, n.d., https://ir.law.fsu.edu/articles/732/.

other research areas involving Mental Data, which currently may not have a well-established ethical framework to guarantee proportionality, is a subject of discussion. For instance, Marcello Ienca points out that there is an argument that areas like cognitive monitoring and self--administered neuromodulation, especially when using non-medical digital mind technologies, may not yet possess a solid ethical framework necessary to ensure their proportionality and justification.[155]

3.3 DPIA as first safety gate of 'risky' processing of Mental Data

I believe that there are ways that lead to appropriate and safer Mental Data processing for the data subject, but the solution does not necessarily lie in "multi-layered sensitivity" as has already been proposed,[156] that could indivertibly stifle innovation and research introducing more complexity in enforcement and compliance, but rather in recognising it as high-risk data that requires specific and tailored Data Protection Impact Assessments (DPIA). By requiring this assessment prior to processing, DPIAs serve as a proactive measure, helping to identify and mitigate risks at an early stage. Consecrated in article 35 of the GDPR, it involves a thorough assessment and mitigation of data processing impacts, which must be conducted prior to processing and regularly updated as risk levels change.[157] This process is particularly relevant for Mental Data due to their sensitive nature and significant implications. The advantages of implementing a Mental DPIA for thoughts as a form of Mental Data are substantial. Firstly, it ensures a rigorous evaluation of potential risks associated with processing such thoughts, safeguarding against any undue infringement on privacy and

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[155] Marcello Ienca, Pim Haselager and Ezekiel Emanuel (n 22); Sara Goering and Rafael Yuste, "On the Necessity of Ethical Guidelines for Novel Neurotechnologies," Cell 167, no. 4 (November 1, 2016): 882–85, https://doi.org/10.1016/j.cell.2016.10.029.

[156] Sara Latini (n 122), page 47.

[157] Dariusz Kloza et al., "Data Protection Impact Assessments in the European Union: Complementing the New Legal Framework towards a More Robust Protection of Individuals," D.Pia. Lab Policy Brief No. 1/2017, October 9, 2020, https://doi.org/10.31228/osf.io/b68em.

personal freedoms. Secondly, the regular review mandated by DPIAs ensures ongoing vigilance and responsiveness to any changes in risk levels, ensuring that protections remain robust over time. This is particularly important for Mental Data like thoughts, which may vary in evaluation of sensitivity depending on context and use.

The European Data Protection Board complemented the three high risks parameters at Article 35(3) with ten risk indexes where two of these apply, the data processing should be considered at high risk and the DPIA should be done.[158] Within this list there are various risks that can be applied to the processing of Mental Data, but considering that I am raising this issue from the point of view of the use of BCI, even though they are not yet capable of accessing thoughts, it is clear that the risk that is raised with the use of innovative technology, defined in "accordance with the achieved state of technological knowledge", recital 91, can trigger the need to carry out a DPIA, 'because the use of such technology can involve novel forms of data collection and usage, possibly with a high risk to individuals' rights and freedoms'.[159] Reconciling this risk with what has already been presented and defended with regard to the sensitivity of Mental Data, it becomes clear that this processing is at high risk and the data controller must, according to Ienca and Malgieri, (i) describe the processing and description of the logic of the technology used;[160] (ii) perform a balancing test based on necessity and proportionality of the data processing in relation to the corresponding purposes;[161] (iii) assessing the risks for fundamental

[158] 'Guidelines on Data Protection Impact Assessment (DPIA) and Determining Whether Processing is "Likely to Result in a High Risk" for the Purposes of Regulation 2016/679', European Data Protection Board, 2017.

[159] Ibid, page 10.

[160] Kaminski, Margot E., and Gianclaudio Malgieri. 2020. "Algorithmic Impact Assessments Under the GDPR: Producing Multi-layered Explanations." International Data Privacy Law 11 (2): 125–44. https://doi.org/10.1093/idpl/ipaa020.

[161] Kloza, Dariusz, Alessandra Calvi, Simone Casiraghi, Sergi V. Maymir, Nikolaos Ioannidis, Alessia Tanas, and Niels van Dijk. 2020. "Data Protection Impact Assessment in the European Union: Developing a Template for a Report from the Assessment Process." LawArXiv. October 9. doi:10.31228/osf.io/7qrfp.

rights and freedoms; (iv) presenting suitable measures to address and mitigate those risks.[162]

Furthermore, the Data Protection Agency can play a crucial role in enhancing the protection of Mental Data. If a controller, after conducting a DPIA, concludes that it is not possible to find adequate solutions to mitigate identified risks, it can seek guidance from the relevant data protection agency. This agency has the capability to provide advice, recommendations, or even impose obligations through discussions with the controller, putting interpreters and stakeholders focus on the processing characteristics, rather than just on the category of data at issue.

Conclusion

It is clear that the modern society stands on the brink of a new era in human-machine interaction, our legal frameworks must be both reactive and proactive. Thoughts are not just binary or linear; they are multi-dimensional, influenced by a myriad of factors like emotions, context, and subconscious elements. Current BCI, while making significant strides, still struggle with capturing this multidimensionality. Nevertheless, law must be vigilant to these technological advances, ensuring that individuals' rights are preserved even as new forms of data emerge. At the same time, it must proactively promote responsible innovation, guiding neurotechnology development in a direction that enhances societal welfare without compromising personal integrity and 'fundamental aspects of human existence, including mental integrity, human dignity, personal identity, freedom of thought, autonomy, and privacy'.[163]

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[162] Marcello Ienca and Gianclaudio Malgieri (n 22), page 18.

[163] "Unveiling the Neurotechnology Landscape: Scientific Advancements Innovations and Major Trends," UNESCO, July 20, 2023, https://www.unesco.org/en/articles/unveiling-neurotechnology-landscape-scientific-advancements-innovations-and-major-trends.

The GDPR's robust approach to personal data protection provides a strong foundation, but it may require further specificity when applied to the nuances of these types of data. For instance, how can consent be meaningful when data subjects may not fully grasp the future implications of sharing their brain and Mental Data? How can privacy be preserved when thoughts and emotions could potentially be decoded and exposed? The answers to these questions lie in a concerted effort by lawmakers, technologists, and ethicists to forge new legal instruments or adapt existing ones to better fit the digital and neural age. This endeavour is not solely about constraining technology but about harnessing its potential responsibly. In the end, the goal of any adaptation in the legal system should be to safeguard the individual's right to cognitive liberty and mental privacy. This means ensuring that people retain control over their own brain and neural data and that they are protected from any form of coercion or discrimination based on that data. It also means fostering an environment where neurotechnology can flourish in a way that is beneficial and ethical, contributing positively to healthcare, education, and beyond.

The CJEU decision presented in this article provides a significant development in data protection law, particularly when it comes to the opening of applicability to thoughts as Mental Data. This decision effectively brings thoughts under the umbrella of sensitive data, recognizing their intrinsic value and the need for stringent protection. By interpreting the processing of Mental Data through the lens of the GDPR, particularly in light of special categories of data, thoughts, as a form of Mental Data, can reveal sensitive information by its own inherent individuality. This interpretation aligns with the broader objectives of the GDPR to protect personal integrity and privacy. Consequently, thoughts are not just seen as mere personal data but are given the elevated status of sensitive data, warranting higher standards of protection. This landmark decision by the CJEU marks a pivotal shift in data protection law, ensuring that thoughts, as intimate reflections of the Self, are safeguarded with the utmost care and diligence in line with the GDPR's principles.

The significance of this development is further amplified by the role of the DPIA, or Mental Data Protection Impact Assessment,[164] as a crucial tool in this context, providing a systematic approach to evaluating and mitigating risks associated with processing such sensitive data. It ensures that any processing of thoughts, now recognized as sensitive data, is preceded by a thorough assessment of potential impacts on privacy and fundamental rights.

One thing is for sure, when brains and machines merge, concepts such as intention and responsibility can become blurred, especially when BCI might act on transient thoughts, leading to disputes over intended actions. Moreover, with the lack of legislation protecting how Mental Data is used, it flags the danger of erosion of testimonial authority and discrimination if biases are built into BCI algorithms.[165]

Given how limited the literature has yet been written on this subject, this article aimed at further intensify the debate on possible technological access to data as personal as that which interrelates in the human mind and the proactive need to have applicable legislation that keeps pace with technological development without unexpectedly falling into a reality where humanity could end up with Mind-Computer Interfaces, for which it is not prepared.

[164] Marcello Ienca and Gianclaudio Malgieri (n 22), page 19.

[165] McBain, Sophie. 2024. "Are You Ready for Elon Musk to Read Your Mind?" New Statesman, January 30, 2024. https://www.newstatesman.com/science-tech/big-tech/2024/01/mind-reading-elon-musk-neuralink.