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Are Technology and the Law on the Same "Wavelength"?: Examining the New Frontier of Brainwaves and Data Privacy

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In 2024, Elon Musk's company, Neuralink, made headlines with the revelations that it had successfully implanted two patients—both paralyzed due to spinal cord injuries—with "brain-computer interfaces" ("BCIs"): chips designed to give them the ability to use digital devices by thinking alone. While seemingly the stuff of science fiction, implantable technology and wearable devices that monitor and use brain waves are already reality. As devices that decode and interpret brain activity with software become more common, there are already at least thirty so-called "neurotechnology" products publicly available. The benefits to be reaped through neurotechnology are significant, and one study estimates an impact of more than seventeen billion dollars by 2026.

Yet beyond these benefits, substantial privacy risks also come with devices that can tap into a person's thoughts. Colorado recently became the first state to enact a data privacy act that includes neural data among the sensitive information protected by law. The law adds biological and neural data to existing legal definitions of "sensitive data" and imposes certain obligations on companies to safeguard such information. California has since followed with a "neural privacy" law of its own, and other states, such as Minnesota, are considering similar laws. Outside the United States, Latin American countries

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like Chile, Mexico, and Brazil are leading the way in recognizing and protecting neural data as part of their own respective data privacy regimens.

Neural data (data collected from brain waves) poses unique concerns within the traditional data privacy framework. It is not biological, like blood or plasma, because it measures electrical activity. It is also not biometric (like a retinal scan or fingerprint) because biometric data is an individually identifiable marker processed outside the body. Consequently, in order to ensure consumer protection, existing data privacy laws need to be updated to account for this increasingly important category of sensitive personal information.

This Article examines privacy law concerns with the collection and commodification of consumer brainwave data. It begins with an explanation of the technology and its applications. The Article continues with an analysis of the various state privacy laws that have been enacted or proposed, comparing and contrasting their respective features. The Article then examines how various nations outside the United States have approached the issue of neural privacy before suggesting ways in which existing data privacy laws may be revised to extend to brain data the same privacy considerations given to fingerprints.

Given the rapid spread and adoption of neurotechnology, this Article is hardly speculative. Society is already facing legal issues arising from similar technology. This Article illuminates the new frontier of brain wave data and its impact on data privacy.

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I. INTRODUCTION

In January of 2025, billionaire entrepreneur Elon Musk announced that a third person had received an implant from Musk's brain-computer interface ("BCI") company, Neuralink.[1] If this patient's experience is anything like those of the previous two Neuralink recipients, his life will be forever changed. Neuralink's first recipient, Noland Arbaugh, had been paralyzed below the shoulders following a spinal cord injury sustained while jumping into a lake.[2] Eight years after that fateful accident, Arbaugh became Neuralink's first human recipient in January of 2024.[3] Thanks to a coin-sized device implanted beneath his skull that uses sixty-four tiny wires equipped with more than one thousand electrodes to read his brain's neuron activity, Arbaugh can control a computer and even play video games.[4]

Neuralink's first three patients are just the start. According to Musk, the company has plans for twenty to thirty more neural implants this year,[5] and at least forty-five clinical trials involving such BCIs are ongoing.[6] Neuralink and other companies doing work in neurotechnology see these advances assisting not only those with spinal cord injuries and paralysis, but also people with amyotrophic

1. Sarah McBride, *Musk Says Neuralink Implanted Third Patient with Brain Device*, BLOOMBERG (Jan. 10, 2025, 9:18 PM CST), https://www.bloomberg.com/news/articles/2025-01-11/musk-says-neuralink-implanted-third-patient-with-brain-device [https://perma.cc/VL3J-V2EB (staff-uploaded, dark archive)].
2. Sony Salzman et al., *Neuralink's First Brain Implant Patient Feared Device Would Have to Be Removed*, ABC NEWS (May 17, 2024, 8:13 AM), https://abcnews.go.com/GMA/Wellness/neuralinks-brain-implant-patient-feared-device-removed/story?id=110325322 [https://perma.cc/JJ9W-BSPF (staff-uploaded)].
3. *Id.*
4. *Id.*
5. McBride, *supra* note 1.
6. *A Third Patient Got a Brain Implant from Elon Musk's Neuralink. How Does the Tech Behind It Work?*, EURONEWS (Jan. 14, 2025, 11:59 AM GMT+1), https://www.euronews.com/health/2025/01/14/a-third-patient-got-a-brain-implant-from-elon-musks-neuralink-how-does-the-tech-behind-it- [perma.cc/JMF7-SC92 (staff-uploaded)].

lateral sclerosis ("ALS"),[7] Parkinson's disease,[8] epilepsy,[9] and even mental illness.[10] These surgically implanted BCIs will usher in life-changing breakthroughs like regaining control of one's limbs or operating computer cursors with one's mind.

Beyond these, some noninvasive BCIs use technology like electroencephalograms ("EEGs")[11] or functional Near-Infrared Spectroscopies[12] ("fNIRs") to record brain activity from the scalp, often ostensibly for wellness purposes.[13] Neurotechnology products are becoming increasingly commonplace: At least thirty companies already offer neurotechnology products to consumers,[14] and other technology giants like Meta, Apple, and Snap are developing their own

7. *Id.*
8. Nathi Magubane, *Challenges and Advances in Brain–Computer Interfaces*, PENN TODAY (June 28, 2023), https://penntoday.upenn.edu/news/challenges-and-advances-brain-computer-interfaces (interview with Dr. Anna Wexler of the Perelman School of Medicine) [https://perma.cc/56PY-TJWS (staff-uploaded)].
9. *Id.*
10. Sophia Chalmer, *How Brain Implants Might Help Combat Mental Illness*, BLOOMBERG (Nov. 25, 2024), https://www.bloomberg.com/news/articles/2024-11-26/video-how-brain-implants-might-help-defeat-mental-illness [https://perma.cc/BM4G-UFMP (staff-uploaded, dark archive)].
11. *EEG (Electroencephalogram)*, MAYO CLINIC, https://www.mayoclinic.org/tests-procedures/eeg/about/pac-20393875, [perma.cc/X76R-WRGD (staff-uploaded)]. An EEG, or Electroencephalogram, is a test that measures electrical activity in the brain, using electrodes that attach to the scalp. *Id.*
12. *Fusion of fNIRS and EEG: A Step Further in Brain Activity Research*, BITBRAIN (Apr. 24, 2024), https://www.bitbrain.com/blog/fusion-fnirs-eeg-brain-activity-research [perma.cc/9XKK-PPA6 (staff-uploaded)]. fNIRS, or functional Near-Infrared Spectroscopy, is a noninvasive brain imaging technique that uses light to measure blood oxygenation levels in the brain. *fNIRS*, IOWA: THE HAPPY BRAIN STUDY, https://happybrain.sites.uiowa.edu/fnirs [https://perma.cc/ED9J-UU4A] (last visited Apr. 26, 2025).
13. Magubane, *supra* note 8.
14. Jared Genser et al., *Safeguarding Brain Data: Assessing the Privacy Practices of Consumer Neurotechnology Companies*, NEURORIGHTS FOUND. 2 (Apr. 2024), https://perseus-strategies.com/wp-content/uploads/2024/04/FINAL_Consumer_Neurotechnology_Report_Neurorights_Foundation_April-1.pdf [https://perma.cc/TE5Z-2VKE (staff-uploaded)].

products.[15] Moreover, neurotechnology is a big business, with one study estimating an impact of more than seventeen billion dollars by 2026.[16]

However, aside from pioneering cutting-edge medical treatments and innovations that promise significant consumer benefits, BCIs and neurotechnology have also raised significant data privacy concerns. Neurotechnology, as a field, refers to devices capable of recording or altering the activity of the human nervous system, which includes the brain, the spinal cord, and the peripheral nerves.[17] Neural data refers to information directly reflecting the activity of an individual's central or peripheral nervous system.[18] This data can reveal incredibly sensitive information about the person from whom it is collected, including identifiable data about her mental health, physical health, and cognitive processing. Could there possibly be any more sensitive and deeply intimate data than one's thoughts?

The brain, after all, is the most complex organ in the human body. It generates all mental and cognitive activity. Neural circuits in the brain create thoughts, memories, and emotions. These circuits guide decision-making and the formulation of individual personalities, identities, and even one's sense of self. Implantable forms of neurotechnology (like BCIs) can already accurately "decode" emotions and language, while wearable forms of neurotechnology are making

15. Nita A. Farahany, *Wearable Brain Devices Will Challenge Our Mental Privacy*, SCI AM (Mar. 27, 2023), https://www.scientificamerican.com/article/wearable-brain-devices-will-challenge-our-mental-privacy/ [https://perma.cc/XY7A-96CJ].

16. THE MARKET FOR NEUROTECHNOLOGY: 2022–2026, NEUROTECH RPTS. (May 2022), https://www.neurotechreports.com/pages/execsum.html [https://perma.cc/4WJW-69M8]; *accord Global Neurotechnology Devices Market Size and Share Analysis – Growth Trends and Forecasts (2022-2025)*, COHERENT MKT. INSIGHTS (Mar. 2025), https://www.coherentmarketinsights.com/industry-reports/global-neurotech-devices-market [https://perma.cc/PA6S-VLLW] (estimating a market of more than thirteen billion dollars by 2025).

17. *See generally* Anastasia Greenberg, *Inside the Mind's Eye: An International Perspective on Data Privacy Law in the Age of Brain-Machine Interfaces*, 29 ALBANY L.J. SCI. & TECH. 79 (2019).

18. Patrick Magee, Marcello Ienca & Nita Farahany, *Beyond Neural Data: Cognitive Biometrics and Mental Privacy*, 112 NEURON 3017, 3017 (2024).

progress in this direction as well.[19] Coupled with technology, the ever-increasing sophistication of artificial intelligence ("AI") accelerates the ability to accurately interpret brainwave patterns or electrical discharges. Suddenly, what a person is thinking, feeling, seeing, or hearing is no longer as private as it once seemed. Put another way, "[w]e can now recognize basic emotional states, unspoken words and imagined movements—all by analyzing neural data."[20]

Society's relationship with data is something of a dichotomy. On the one hand, people are increasingly comfortable with quantifying themselves. People wear Apple Watches or fitness trackers that monitor their heart rates, Oura Rings that track their sleep patterns or temperature, and a myriad of other devices with sensors. At the same time, the United States ("U.S.") data privacy framework has never been more active; there are currently twenty states with comprehensive data privacy laws.[21] A handful of states—Illinois, Texas, and Washington—have enacted broad biometric data privacy laws to protect data collected from things like facial recognition, handprint, or retinal scans, and a few others have passed narrower measures relating to biometric information.[22] Yet, despite the highly sensitive nature of *neural* data, only two states—Colorado and California—have passed data privacy laws that protect it.[23]

Why is this? Why, at a time when neurotechnology is becoming increasingly ubiquitous, does the protection of neural data privacy lag so far behind? How could policymakers improve their approach to this form of data privacy such that brainwaves enjoy the same level of protection as Social Security numbers or fingerprints? This Article suggests how such improvement may be achieved.

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19. *See generally* NITA A. FARAHANY, THE BATTLE FOR YOUR BRAIN: DEFENDING THE RIGHT TO THINK FREELY IN THE AGE OF NEUROTECHNOLOGY (2023).

20. Kaveh Waddell, *Brains Are the Last Frontier of Privacy*, AXIOS (Sept. 21, 2019), https://www.axios.com/2019/09/21/brain-privacy-neuralink-brain-computer-interface [https://perma.cc/82XW-DZY3 (staff-uploaded)].

21. F. Paul Pittman et al., *US Data Privacy Guide*, WHITE & CASE (Jan. 20, 2025), https://www.whitecase.com/insight-our-thinking/us-data-privacy-guide [perma.cc/JW53-9FVJ (staff-uploaded)].

22. John G. Browning, *Is the Devil in the Details? Religious Objections to Biometric Technology in the Workplace*, 99 U. DET. MERCY L. REV. 299, 301 (2022).

23. *See infra* Part IV.

The Article begins in Part II with an overview of neurotechnology and its applications. It then continues by providing an international perspective on neural privacy in Part III, examining legislative efforts in nations like Chile, Mexico, and Brazil. Then, in Part IV, the Article critically examines recently enacted neural privacy laws in Colorado and California—as well as a proposed neural privacy law in Minnesota—and assesses their respective features. Finally, in Parts V and VI, the Article concludes with a look at the need for stronger neural privacy laws and offers suggestions for buttressing or extending existing data privacy laws to address brainwave data.

Neural data has been described as "the last frontier of privacy."[24] Neurotechnology, like virtually every other form of technology, is advancing at a pace that considerably outstrips existing law. The data privacy issues that neurotechnology present are merely the tip of the iceberg of potential legal concerns arising from this technology; consumer protection, product liability, and intellectual property rights are other potential concerns.[25] Even employment law may be impacted by neurotechnology; a recent Massachusetts federal case involved an unsuccessful job candidate's claim against an AI company that conducted "lie detector"-like analysis of facial and vocal expressions to purportedly gauge "integrity and honor."[26] Neurotechnology will continue to spur novel privacy concerns and raise new legal issues. Whether it will spur new legislation remains to be seen, as technology and the law strive to get on the same wavelength.

II. BCIs and Neurotechnology: An Overview

To grasp the importance of safeguarding the privacy of brainwave data or neural data, one must first gain a more complete understanding of neurotechnology as a field generally and BCIs in particular. This Article uses the term "neurotechnology" or "neurotechnologies" to refer to devices that record, measure, or alter the activity of the brain as well as the central and peripheral nervous systems.

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24. Waddell, *supra* note 20.

25. *See generally* FARAHANY, *supra* note 19.

26. Baker v. CVS Health Corp., 717 F. Supp. 3d 188, 191 (D. Mass. 2024).

There are numerous ways these devices can measure neural activity. One direct method is by using an EEG to measure the electrical signals emitted by neurons.[27] There are also indirect methods, such as a functional magnetic resonance imaging ("fMRI") scan that tracks the blood flow related to neural activity.[28] An fMRI scan shows activity in certain areas of the brain.[29] Because brain cells use increased levels of oxygen when they are working, mapping out the areas of the brain based on blood flow shows what parts are working the hardest—for example, the portion of the frontal lobe that controls muscle movements.[30] Neurotechnologies may employ not only magnetic systems like this, but also electronic, mechanical, or optical systems.[31]

As one example of neurotechnology at work, consider epilepsy—the most common form of brain disorder, affecting approximately fifty million people around the world.[32] Epileptic seizures occur due to brief bursts of abnormal electrical signals in the brain.[33] In its most dramatic form, a grand mal seizure might send a person into convulsions and render them unconscious.[34] Other seizures might give the person a feeling of disorientation; in others still, the individual might appear normal despite being in a trance-like state.[35] While there are a variety of anti-seizure medications available for those suffering from epilepsy, a significant percentage of both adults and children with epilepsy either do not respond well to anti-seizure medications or find them to

27. *EEG (electroencephalogram)*, *supra* note 11.

28. *What is Functional MRI?*, CLEV. CLINIC, https://my.clevelandclinic.org/health/diagnostics/25034-functional-mri-fmri [https://perma.cc/WL6K-YMED (staff-uploaded)] (last updated May 27, 2023).

29. *Id.*

30. *Id.*

31. *See, e.g.*, Jeremiah Wander & Rajesh Rao, *Brain-Computer Interfaces: A Powerful Tool for Scientific Inquiry*, 25 CURRENT OP. NEUROBIOLOGY 70, 71–73 (2014).

32. *Epilepsy*, WORLD HEALTH ORG. (Feb. 7, 2024), https://www.who.int/news-room/fact-sheets/detail/epilepsy [perma.cc/XY8E-XBPW (staff-uploaded)].

33. *Id.*

34. Ken Harris, *The Dangers of Seizures: Why You Need Immediate Treatment*, OSF HEALTHCARE BLOG (June 17, 2024), https://www.osfhealthcare.org/blog/dangers-of-seizures/ [perma.cc/6JFF-DE4Z (staff-uploaded)].

35. *Id.*

be increasingly ineffective as their brains develop a tolerance for them.[36]

Neurotechnologies may provide some solutions. EEGs have been found effective for helping epilepsy patients by both diagnosing and managing the disorder, yielding brain data that can discern the "neural signature" of an impending seizure.[37] Researchers with Ben-Gurion University of the Negev in Israel, for example, have developed a wearable EEG device called the Epiness.[38] According to these scientists, the Epiness can predict seizures up to one hour before they occur and send an alert to the user's smartphone.[39] Equipped with such a device, a person with epilepsy could lead a more normal life, accomplishing tasks like commuting to work secure in the knowledge that an epileptic seizure will not lead to an accident on the way.

There are many other uses heralded for neurotechnologies. One South Korean biomedical company, iMediSync, is marketing an EEG device that detects the mild cognitive impairment that accompanies early Alzheimer's dementia with ninety percent accuracy, along with other disorders such as Parkinson's disease, traumatic brain injury, depression, post-traumatic stress disorder, and more.[40] In addition, there are a growing number of wellness-related neurotechnology products, many of which purport to deepen one's sleep state, reduce stress and anxiety, enhance productivity, sharpen focus, or otherwise improve cognitive health.[41] Such products include an EEG headband

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36. *Drug Resistant Epilepsy*, EPILEPSY FOUND. (Oct. 5, 2020), https://www.epilepsy.com/treatment/medicines/drug-resistant-epilepsy [https://perma.cc/P7UG-XQLC (staff-uploaded)].

37. Xinzhong Zhu et al., *Automated Epileptic Seizure Detection in Scalp EEG Based on Spatial-Temporal Complexity*, COMPLEXITY, Dec. 27, 2017, at 6–7, https://onlinelibrary.wiley.com/doi/epdf/10.1155/2017/5674392 [https://perma.cc/JWB3-C6J9 (staff-uploaded)].

38. Kris Holt, *Researchers Say They Can Predict Epileptic Seizures an Hour in Advance*, ENGADGET (Sept. 29, 2020), https://www.engadget.com/epileptic-seizure-prediction-device-research-180142222.html [perma.cc/PNE8-RNPB (staff-uploaded)].

39. *Id.*

40. *AI Gives You a Chance to Prevent Alzheimer's Dementia*, IMEDISYNC (Jan. 8, 2021), https://ces.vporoom.com/iMediSync/AI-gives-you-a-chance-to-prevent-Alzheimers-Dementia [https://perma.cc/M37R-M824 (staff-uploaded)].

41. *See generally* FARAHANY, *supra* note 19.

that supposedly triggers lucid dreaming[42] and a headset that provides home treatment for depression using transcranial Direct Current Stimulation.[43]

Other neurotechnology products are marketed with a consumer's love life or entertainment interests in mind. Brainbit offers a headset that brings neural insights to online dating, touting to customers: " '[L]isten to your heart' is not enough. Listen to your brain and swipe according to your instinctive reaction."[44] In 2022, cosmetics giant L'Oreal launched a joint venture with the neurotechnology company EMOTIV to use EEG technology in its stores as part of personalized fragrancy consultations that would identify fragrance preferences through neural activity.[45] EMOTIV's CEO hailed the partnership, saying, "[t]ogether with L'Oreal, we hope this partnership provides unique insights into how consumers feel about fragrances and about how scents make them feel through an unbiased lens."[46] There are also neurotechnology products to augment user engagement with movies and videogames; one device even allows users to "fly" a helicopter using their thoughts about where they want it to go.[47]

Many people associate neurotechnology with BCIs (sometimes known as "brain-machine interfaces," or BMIs). As their name implies, BCIs facilitate communication between the brain and the outside world, either by exporting brain data or by altering brain activity.[48]

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42. *Lucid Dreaming with iBandt*, IBANDT, https://www.ibandplus.com/lucid-dreaming/ [https://perma.cc/SH6A-4NXX] (last visited Mar. 19, 2025).

43. *Flow Neuroscience*, FLOW, https://www.flowneuroscience.com/ [https://perma.cc/NC9D-PCVQ (staff-uploaded)] (last visited Mar. 19, 2025).

44. *Other Areas of Use*, BRAINBIT, https://brainbit.com/other/ [perma.cc/Y9KS-6J7D (staff-uploaded)] (last visited Mar. 19, 2025).

45. *L'Oreal, in Partnership with Global Neurotech Leader, EMOTIV, Launches New Device to Help Consumers Personalize Their Fragrance Choices*, L'OREAL FIN. (Mar. 21, 2022), https://www.loreal-finance.com/eng/news-event/loreal-partnership-global-neurotech-leader-emotiv-launches-new-device-help-consumers [perma.cc/9NZX-THRB (staff-uploaded)].

46. *Id.*

47. *NeuroSky Store*, NEUROSKY, https://www.neurosky.com/ [perma.cc/K8EK-Z8BN (staff-uploaded)] (last visited Mar. 19, 2025).

48. *What Is a Brain Computer Interface?*, UNIV. OF CALGARY: CUMMING SCH. OF MED., https://cumming.ucalgary.ca/research/pediatric-bci/bci-program/what-bci [https://perma.cc/XTN5-583P] (last visited Apr. 3, 2025).

Arguably, the best-known BCIs are invasive (where a chip is implanted in the brain), but there are noninvasive ones as well (where a device, such as a helmet or headband, is worn).[49] Invasive BCIs, which require surgery to implant, are regulated as medical devices—a status that includes a heightened protection of health data.[50] Examples of invasive BCIs include: deep brain stimulators, which can help people suffering with Parkinson's disease regain mobility; brain chips for nonverbal ALS patients that enable them to write, use email, and otherwise communicate without speaking; and brain implants that assist amputees with "feeling" hot and cold through their prostheses.[51]

The success stories with invasive BCIs are nothing short of amazing. In 2023, one such BCI helped a woman, who had lost her ability to speak after a stroke, "speak" again.[52] Using an intracranial (within the skull) EEG and employing a generative AI algorithm, researchers were able to "decode" her inner language, emotions, and basic facial muscle movements.[53] Using these, they created a digital avatar that replicated her own voice and facial expressions, allowing her to once again communicate.[54]

Other notable breakthroughs abound: Thanks to invasive BCIs, a quadriplegic man was able to drive a Formula One race car.[55] Using a mind-controlled exoskeleton, a paraplegic man made the ceremonial first kick of the World Cup.[56] And visually impaired or blind people may be able to use a BCI that bypasses the eyes and taps directly into

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49. *Id.*

50. Anna Wexler & Peter B. Reiner, *Oversight of Direct-to-Consumer Neurotechnology*, 363 SCI. 234, 234–35 (2019).

51. Rafael Yuste, Jared Genser & Stephanie Herrmann, *It's Time for Neurorights: New Human Rights for the Age of Technology*, CTR. INT'L RELS. & SUSTAINABLE DEV.: HORIZONS, Winter 2021, Issue 18, at 154, 156.

52. Cassandra Willyard, *Brain Implants Helped Create a Digital Avatar of a Stroke Survivor's Face*, MIT TECH. REV. (Aug. 23, 2023), https://www.technologyreview.com/2023/08/23/1078312/brain-implants-digital-avatar-stroke/ [perma.cc/ADR4-4FWZ (staff-uploaded)].

53. *Id.*

54. *Id.*

55. Yuste et al., *supra* note 51, at 157.

56. Alejandra Martins & Paul Rincon, *Paraplegic in Robotic Suit Kicks Off World Cup*, BBC NEWS (June 12, 2014), https://www.bbc.com/news/science-environment-27812218 [perma.cc/Q7Q4-HTXJ (staff-uploaded)].

the brain to provide a rudimentary form of vision.[57] Not to be outdone, Neuralink recently received an FDA Breakthrough Device designation[58] for Blindsight, an implant that hopes to restore vision for the blind.[59] The device "implants a microelectrode array into the visual cortex of a person's brain" that "activates neurons, which then provide the individual with a visual image."[60]

However, Musk and Neuralink are not merely content with making the device worn by Star Trek's Geordi La Forge a reality. Thirty-year-old quadriplegic Nolan Arbaugh, the first person to receive Neuralink's BCI, says the chip has changed his life, enabling him "to have nearly full control over using a computer—using only his thoughts."[61]

Neuralink is not the only option for BCI. A growing number of companies are entering the invasive BCI space. Paradromics, founded in 2015, anticipates its first human trial in 2025.[62] The Texas-based company plans to target its devices for patients "who have lost their ability to communicate first, whether that be due to paralysis, diseases such as . . . ALS, or spinal injury."[63] Paradromics expects to obtain

57. Russ Juskalian, *A New Implant for Blind People Jacks Directly Into the Brain*, MIT TECH. REV. (Feb. 6, 2020), https://www.technologyreview.com/2020/02/06/844908/a-new-implant-for-blind-people-jacks-directly-into-the-brain/ [perma.cc/LL4G-UE7H (staff-uploaded)].

58. "The FDA Breakthrough Device Designation was created in 2015 to expedite device access for life-threatening and debilitating diseases." Robert Packard, *What Is the FDA Breakthrough Device Designation?*, MED. DEVICE ACAD. (April 16, 2024), https://medicaldeviceacademy.com/breakthrough-device-designation/ [https://perma.cc/3GEG-CRJK].

59. Jessica Hagen, *Elon Musk's Neuralinks Device Blindsight Gets FDA Breakthrough Device Designation*, MOBI HEALTH NEWS (Sept. 19, 2024, 11:41 AM), https://www.mobihealthnews.com/news/elon-musk-s-neuralink-device-blindsight-gets-fda-breakthrough-device-designation [https://perma.cc/KG3H-X75G (staff-uploaded)].

60. *Id.*

61. Salzman et al., *supra* note 2.

62. Maria Gomez De Sicart & Cristy Garratt, *Neuralink Competitor Paradromics Gears Up to Test Its Brain Implant on Humans*, CNBC (June 21, 2024, 7:36 AM), https://www.cnbc.com/2024/06/21/paradromics-gears-up-to-test-its-brain-implant-on-humans.html [https://perma.cc/3HZ8-XTSX (staff-uploaded)].

63. *Id.*

commercial approval for its wireless device by 2029 and anticipates that each device will retail for about one hundred thousand dollars.[64]

Synchron, a New York-based company backed by tech luminaries like Jeff Bezos and Bill Gates, has implanted its BCI in ten people.[65] Another company, Blackrock Neurotech, has implanted its "Utah Array" in "dozens of people," and its MoveAgain device received an FDA Breakthrough Designation in 2021.[66] Yet another company, Motif Neurotech, says the goal of its implanted device (the Digitally Programmable Over-Brain Therapeutic, or "DOT") is to alleviate mood disorders, not produce movement.[67] According to the company's CEO, "for every person with a spinal cord injury, there are 10 people suffering major depressive disorder and not responding to drugs. They're just as desperate. It's just not visible."[68]

Neuralink has European competitors as well. France's Inclusive Brains demonstrated its BCI advances by sending a message to French President Emmanuel Macron on X using a device controlled only by head movement (to control the computer cursor) and brainwaves (to click the mouse through a small headset).[69] And in the Netherlands, a man paralyzed twelve years ago in a bicycle accident regained the ability to walk using only his thoughts—thanks to two implants forming a "digital bridge" between his spinal cord and brain.[70]

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64. *Id.*

65. Cassandra Willyard, *Beyond Neuralink: Meet the Other Companies Developing Brain–Computer Interfaces*, MIT TECH. REV. (Apr. 19, 2024), https://www.technologyreview.com/2024/04/19/1091505/companies-brain-computer-interfaces [https://perma.cc/3U6Y-6Q8T].

66. *Id.*

67. *Id.*

68. *Id.*

69. Pascale Davies, *France's Answer to Neuralink Sends Message to Macron Using Movement and Brainwaves in World First*, EURONEWS (May 31, 2024, 11:37 AM), https://www.euronews.com/next/2024/05/31/frances-answer-to-neuralink-sends-message-to-macron-using-movement-and-brainwaves-in-world [https://perma.cc/ZBV4-P5QT].

70. *Paralyzed Man Walks Again Thanks to Groundbreaking Thought-Controlled Implants*, EURONEWS (May 25, 2023, 10:59 AM), https://www.euronews.com/2023/05/25/paralysed-man-walks-again-thanks-to-groundbreaking-thought-controlled-implants [https://perma.cc/2J6N-4KXL].

Yet while BCIs in particular, and the field of neurotechnology generally, offer seemingly boundless benefits for recipients and unparalleled tools for doctors combatting a wide variety of health issues, their development also raises significant privacy concerns. Because neurotechnologies have the potential to "track the code" of a wide variety of brain activity (including thoughts, emotions, and memories), they raise the inevitable question of unauthorized access to this private information. Beyond inferring commands a user *intends* to send to a device (like moving a computer cursor or steering a wheelchair), this technology may also infer personal details such as sexual orientation *without* the user's consent.[71] In addition, BCI-collected data could be used for unintended purposes, revealing sensitive information to others—including companies or governments. Malicious actors could exploit vulnerabilities to steal sensitive data or even manipulate a user's thoughts through BCI.[72]

Such concerns are genuine. According to a study by OpenBCI, a Brooklyn-based neurotechnology company, seventy-three percent of those who either use or are interested in using neurotechnology to improve their lives report being concerned about their brainwave devices.[73] A leading concern for these respondents was that their data would be misused or fall into the wrong hands; nearly half (forty-six percent) were extremely concerned about Facebook accessing neural data, while a roughly equal percentage were extremely concerned about other tech companies and the government doing so.[74]

As this Article later discusses, steps have already been taken on the international front to protect neural privacy and prevent brainwave

71. *See generally* Anastasios Ziogas et al., *Deep Learning in the Identification of Electroencephalogram Sources Associated with Sexual Orientation*, 82 NEUROPSYCHOBIOLOGY 234 (2023).

72. Jennifer Dickey, *Hacking the Brain: Innovations and Implications of BCIs*, NEW AM.: BLOG (July 8, 2024), https://www.newamerica.org/future-security/stmic-fellowship/blog-posts/stmic-fellow-perspective-hacking-the-brain-innovations-and-implications-of-bcis [https://perma.cc/3FLK-GPRH].

73. Press Release, OpenBCI, OpenBCI Releases New Report About Biometrics and Brain Privacy (Mar. 10, 2021), https://openbci.com/community/closing-the-loop-report-results-2021 [https://perma.cc/ZB2B-8N7H].

74. *Id.*

activity from being exploited for commercial gain.[75] In the United States, lawmakers in states like Colorado and California have begun to navigate these uncharted waters. The challenge everywhere lies in maintaining the delicate balance of encouraging innovation while protecting one's most intimate data so that neurotechnology may continue to serve humanity without compromising human rights.

III. INTERNATIONAL PERSPECTIVES ON NEURAL PRIVACY

On the international stage, there have been significant advances in protecting the privacy of neural data. In September of 2021, United Nations ("U.N.") Secretary-General António Guterres issued a report calling upon the international community to further the organization's goals by "clarifying our application of human rights frameworks and standards to address frontier issues and prevent harms in the digital or technology spaces, including . . . neuro-technology."[76]

This, the first mention of neurotechnology by any U.N. Secretary-General, was followed by a decision in the fall of 2022 by the U.N. Human Rights Council. The Council unanimously adopted a resolution requesting its Advisory Committee to prepare a study on neurotechnology and human rights to be presented in the fall of 2024.[77] In July of 2023, the United Nations Educational, Scientific and Cultural Organization ("UNESCO") held an international conference devoted to the "Ethics of Neurotechnology" and subsequently published several reports on neurotechnology.[78]

And while the United States may lack a federal comprehensive data privacy law, the European Union ("E.U.") does not. In 2016, the

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75. *See infra* Part III.

76. U.N. Secretary-General, *Our Common Agenda: Report of the Secretary-General*, at II-33, U.N. Sales No. E.21.I.8 (2021), https://www.un.org/en/content/common-agenda-report/assets/pdf/Common_Agenda_Report_English.pdf [https://perma.cc/88K2-N5MN].

77. Human Rights Council Res. 51/3, U.N. Doc. A/HRC/RES/51/3 at 2 (Oct. 6, 2022), https://docs.un.org/en/A/HRC/RES/51/3 [https://perma.cc/VG6K-RVC9].

78. *See generally International Conference on the Ethics of Neurotechnology*, UNESCO (July 13, 2023), https://www.unesco.org/en/neuroethics-conference [https://perma.cc/532Q-NRRX (staff-uploaded)].

E.U. adopted the General Data Privacy Regulation[79] ("GDPR"), which has been described as "one of the most advanced and comprehensive data protection laws in the world."[80] According to the definition contained in Article 4(1) of the GDPR, data related to the human brain is considered personal data if it allows the human subject to be singled out.[81] However, while Article 4(1) describes a possible list of "identifiers"[82] and mentions "one or more factors specific to the . . . mental . . . identity" of a natural person, the GDPR never defines what it means by mental identity.[83]

Since many types of neural data are uniquely tied to an individual (such as through an EEG), it stands to reason that they would be sufficient to identify a natural person and therefore qualify as personal data. There is, however, an ongoing debate as to whether neural data that might be used to infer the mental health status of an individual, or to reveal information about such things as sexual orientation, would be automatically considered "sensitive data" under Article 9(1) of the GDPR.[84]

There has also been significant progress regarding neural privacy rights at the national level in multiple countries. In 2021, Spain adopted the Charter on Digital Rights,[85] a document that specifically

79. Regulation 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 (General Data Protection Regulation), O.J. (L 119) 1 [hereinafter GDPR].

80. Marcello Ienca & Gianclaudio Malgieri, *Mental Data Protection and the GDPR*, J.L. & BIOSCI., Apr. 25, 2022, at 1, 7, https://doi.org/10.1093/jlb/lsac006 [https://perma.cc/A873-RE9A].

81. *See* GDPR, *supra* note 79, at art. 4(1).

82. *Id.* (giving names, identification numbers, location data, and online identifiers as examples).

83. *See id.*

84. *See, e.g.*, Stephen Rainey et al., *Is the European Data Protection Regulation Sufficient to Deal with Emerging Data Concerns Relating to Neurotechnology?*, J.L. & BIOSCI., June 27, 2020, at 1, 11, https://doi.org/10.1093/jlb/lsaa051 [https://perma.cc/HMH7-86YB].

85. CARTA DERECHOS DIGITALES [DIGITAL BILL OF RIGHTS], PLAN DE RECUPERACIÓN, TRANSFORMACIÓN Y RESILIENCIA, GOBIERNO DE ESPAÑA (2021) (Spain), https://www.lamoncloa.gob.es/presidente/actividades/Documents/2021/140721-Carta_Derechos_Digitales_RedEs.pdf [https://perma.cc/5MNB-W7H3].

refers to "digital rights in the use of neurotechnologies" and emphasizes the importance of "mental agency," privacy, and nondiscrimination.[86] Similarly, in November of 2023, Mexico's Data Protection Authority promulgated a Digital Human Rights Charter[87] that recognized five fundamental "neurorights": (1) the right to mental privacy; (2) the right to personal identity, under which neurotechnology should not be allowed to alter one's sense of self; (3) the right to free will, under which neurotechnology should not be permitted to control decision-making; (4) the right to fair access to mental augmentation, or the accessibility of "cognitive enhancement neurotechnology"; and (5) the right to be protected from bias or discrimination in neurotechnology algorithms.[88]

In the spring of 2024, Mexico also began consideration of two neuroprivacy bills that would amend the country's constitution.[89] The first of these would amend the Mexico Constitution to include a right to individual identity, including a government obligation to respect "mental privacy and integrity."[90] The proposed bill includes legal

86. *Id.* at 28; *The Government Adopts Digital Rights Charter to Articulate a Reference Framework to Guarantee Citizens' Rights in the Digital Age*, LA MONCLOA (Spain) (July 14, 2021), https://www.lamoncloa.gob.es/lang/en/gobierno/news/Paginas/2021/20210713_rights-charter.aspx [https://perma.cc/Z8GC-RSN2].

87. El Instituto Nacional de Transparencia, Acceso a la Información y Protección de Datos Personales, Carta de Derechos de la Persona en el Entorno Digital: Código de Buenas Prácticas (2023) (Mex.), https://www.infocdmx.org.mx/doctos/2022/Carta_DDigitales.pdf [https://perma.cc/3P7V-3533]. The Charter was adopted on October 9, 2023, and published into law on November 10, 2023. Diario Oficial de la Federación [DOF] 10-11-2023 (Mex.) (citing Acuerdo Mediante el Cual el Consejo Nacional del Sistema Nacional de Transparencia, Acceso a la Informacion Publica y Proteccion de Datos Personales, Aprueba el Código de Buenas Prácticas Denominado: "Carta de Derechos de la Persona en el Entorno Digital," https://www.dof.gob.mx/2023/INAI/CONAIP-SNT-ACUERDO-ORD02-09-10-2023-04.pdf [https://perma.cc/7NKL-K6GD]).

88. CARTA DE DERECHOS DE LA PERSONA EN EL ENTORNO DIGITAL: CÓDIGO DE BUENAS PRÁCTICAS, *supra* note 87, at 58–60; Beth Do et al., *Privacy and the Rise of "Neurorights" in Latin America*, FUTURE OF PRIVACY FORUM: BLOG (Mar. 20, 2024), https://fpf.org/blog/privacy-and-the-rise-of-neurorights-in-latin-america [https://perma.cc/DHA7-R2P4].

89. Do et al., *supra* note 88.

90. *Id.* (citing Iniciativa con Proyecto de Decreto por la que se Adiciona un Noveno Parrafo y se Recorren los Subsecuentes del Artículo 4°; de la

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measures safeguarding "the confidentiality of neurodata collection, informed consent before access, clear limits on neurotechnologies and anti-discrimination measures."[91] The second bill would amend the Mexico Constitution to permit congressional authority to pass laws protecting, among other things, "mental privacy, cognitive autonomy," and "informed consent for the use of brain data, identity and self-expression."[92]

Brazil is yet another country that has explored neuroprivacy rights. In December of 2023, one of the country's biggest states, Rio Grande do Sul, amended its constitution to encompass neurorights, "specifying mental integrity as a constitutional principle."[93] That same month, Brazil's Sub-Committee on Digital Law of the Commission of Jurists (the body that reviews and updates the country's Federal Civil Code) recommended recognizing neuroprivacy under the General Data Protection Law[94] ("LGPD"), the nation's counterpart to the E.U.'s GDPR.[95] The previous year, in March of 2022, Brazil began consideration of a bill that would amend the LGPD to regulate the processing of neural data.[96] Under this bill, informed consent would

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Constitución Política de los Estados Unidos Mexicanos, Gaceta Parlamentaria: LXV/2SPR-28/136820 (as introduced Aug. 8, 2023) (Mex.), http://sil.gobernacion.gob.mx/Archivos/Documentos/2023/08/asun_4588906_20230808_1690903141.pdf [https://perma.cc/CFY5-2JBN]).

91. *Id.* (citing Iniciativa . . . por la que se Adiciona un Noveno Parrafo y se Recorren los Subsecuentes del Artículo 4º; de la Constitución Política de los Estados Unidos Mexicanos, Gaceta Parlamentaria, *supra* note 90).

92. *Id.* (citing Iniciativa con Proyecto de Decreto por el que se Reforma pa Fracción XVII, al Artículo 73 de da Constitución & Política de los Estados Unidos Mexicanos, en Materia de Inteligencia Artificial, Ciberseguridad y Neuroderechos, Gaceta del Senado: LXV/3PPO-17/137999 (as introduced Sept. 26, 2023) (Mex.), https://infosen.senado.gob.mx/sgsp/gaceta/65/3/2023-09-26-1/assets/documentos/Inic_PVEM_diversos_senadores_art_73_CPEUM.pdf).

93. *Id.* (citing Constituição do Estado do Rio Grande do Sul [Constitution] art. 235 (Rio Grande do Sul, Braz.).

94. Lei No. 13.709, de 14 de Agosto de 2018, Diário Oficial da União [D.O.U.] de 15.8.2018 (Braz.).

95. Do et al., *supra* note 88 (citing SUBCOMISSÃO DE DIREITO DIGITAL, COMISSÃO DE JURISTAS, PARECER Nº 1 – SUBCOMISSÃO DE DIREITO DIGITAL DA CJCODCIVIL (2023), https://legis.senado.leg.br/sdleg-getter/documento/download/34470bd2-bc45-4144-aa1c-7941d5488cod).

96. *Id.* (citing PL 522/2022 (2022) (Braz.)).

be required, with the consent request clearly indicating "the possible physical, cognitive and emotional effects of" such processing.[97] The bill received preliminary approval in October of 2023.[98]

No country, however, has done as much to protect neural data privacy as Chile. In 2021, it became the first nation to amend its constitution to do so.[99] The amendment in question states that "the law shall regulate the requirements, conditions, and restrictions for [neural data], and shall especially protect brain activity, as well as the information derived from it."[100] Any advances in science and technology, it adds, must be performed with respect for "mental integrity."[101] Two years later, the Chilean Senate unanimously approved a neuroprotection law.[102] Building on this, a bill spearheaded by Senator Guido Girardi Lavín, if enacted, would further define individual physical and psychological integrity and require consent to use neurotechnology.[103]

It would not be long before Senator Girardi's law would be put to the test, and in the most direct of ways for the politician. Girardi had purchased the "Insight" device, an EEG headset manufactured and sold by EMOTIV for use in so-called "neuromarketing" and measuring consumer preferences.[104] After purchasing the device online and

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97. *Id.* (citing PL 522/2022 at 3).

98. *Id.*

99. *Id.* (citing Law No. 21383, Modifica la Carta Fundamental, Para Establecer el Desarrollo Científico y Tecnológico al Servicio de las Personas, Octubre 25, 2021, Diario Oficial [D.O.] (Chile), which modified Constitución Política de la República de Chile [C.P.] art. 1 ¶ 19)).

100. *Id.* (citing Law No. 21383, Octubre 25, 2021, Diario Oficial [D.O.] (Chile)).

101. *Id.* (citing Law No. 21383, Octubre 25, 2021, Diario Oficial [D.O.] (Chile)).

102. Maria Badillo, *Chile's New Data Protection Law: Context, Overview, and Key Takeaways*, FUTURE OF PRIV. F. (Feb. 27, 2025), https://fpf.org/blog/chiles-new-data-protection-law-context-overview-and-key-takeaways/ [https://perma.cc/Z2YA-4D2R] (citing Law No. 21719, Regula la Protección y el Tratamiento de los Datos Personales y Crea la Agencia de Protección de Datos Personales, Diciembre 13, 2024, Diario Oficial [D.O.] (Chile)).

103. Do, *supra* note 88 (citing Sobre Protección de los Neuroderechos y la Integridad Mental, y el Desarrollo de la Investigación y las Neurotecnologías, No. 13828 19, 368º Legislatura (2020)).

104. Avi Asher-Schapiro & Diana Baptista, *Hands Off My Brainwaves: Latin America in Race for "Neurorights"*, REUTERS (Sept. 12, 2023, 5:00 AM), https://

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installing its software on his computer, Girardi was unable to access his own brainwave data, which he contended was recorded by EMOTIV and stored in the company's cloud-based servers—without his consent.[105]

Girardi sued EMOTIV in Chile, alleging that he was exposed to the risk of having his neural data hacked, used, or sold without his permission and for unauthorized purposes.[106] Girardi maintained that EMOTIV had violated not only Chile's neural privacy statute but also the terms of Chile's constitutional protections for "mental integrity."[107] EMOTIV argued that its users' data would be anonymized before any use and that all product users signed consent forms allowing for the capture of their data.[108]

The case went to the Chilean Supreme Court. In an August 2023 landmark ruling, the court rejected EMOTIV's argument that Girardi's captured brainwave data was anonymized and merely "statistical."[109] It also rejected EMOTIV's argument that consent had been given. Pointing to not only Chile's neural privacy law and amended constitution, but also international laws and Chilean laws on scientific research, the court held that informed consent had not been given.[110] Such consent, the court ruled, must not only be specific as to the purpose of the research but also obtained each time the terms

www.reuters.com/article/technology/hands-off-my-brainwaves-latin-america-in-race-for-neurorights-idUSL8N3AH6D6 [https://perma.cc/PZH8-H745 (staff-uploaded)].

105. *Id.*

106. *Id.*

107. *Id.*

108. *Id.*

109. *Id.* (discussing Corte Suprema de Justicia [C.S.J.] [Supreme Court], 9 augusto 2023, "Girardi c. Emotiv Inc.," Rol de la causa:105065-2023 apelación a recurso de protección, En Buscador Jurisprudencial de la Corte Suprema, https://juris.pjud.cl/busqueda/u?c5762 [https://perma.cc/X6V2-2TT4] (Chile)).

110. Maria Isabel Cornejo-Plaza et al., *Chilean Supreme Court Ruling on the Protection of Brain Activity: Neurorights, Personal Data Protection, and Neurodata*, FRONTIERS PSYCH., Feb. 27, 2024, at 1, 7, https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1330439/full [https://perma.cc/XS8V-KYYU (staff-uploaded)].

and conditions are modified.[111] The Supreme Court ordered EMOTIV to delete all of Girardi's data.[112] On its own volition, the company halted all sales in Chile.[113]

The Chilean Supreme Court ruling was the first of its kind and has inspired interest in neural privacy legislation in other countries, such as Uruguay.[114] Girardi himself reacted to the decision by calling brainwave data "the next battleground for human freedom."[115] And while the work of companies like Neuralink may demonstrate the "better angels" of neurotechnology, companies like EMOTIV are proof of the darker potential of collecting and using brain data. While it can give spinal cord patients their lives back, it can also serve crass goals, like targeted advertising or manipulating consumers' moods. This tension underscores the need for neural privacy law.

IV. NEURAL PRIVACY LAWS IN THE U.S.

A. An Overview

Unlike the E.U. and numerous individual nations, the U.S. lacks a comprehensive federal law that generally regulates privacy and the collection, processing, storage, disclosure, and use of "personal information" (which is usually defined as information that identifies, relates to, or is reasonably capable of being linked to a particular individual).[116] The federal laws governing the privacy rights Americans *do* have are invariably limited in their application to specific types of personal information or to specific industries, such as healthcare. For example, the Health Insurance Portability and Accountability Act of

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111. *Girardi*, Rol de la causa:105065-2023, *supra* note 109 (discussing Law No. 20120, Sobre la Investigacion Cientifica en el Ser Humano, su Genoma, y Prohibe la Clonacion Humana, Septiembre 22, 2006, Diario Oficial [D.O.]).

112. Asher-Schapiro & Baptista, *supra* note 104.

113. *Id.*

114. @TelemundoUY, X (formerly TWITTER) (Feb. 12, 2024, 6:43 PM), https://x.com/TelemundoUY/status/1757188638889197862 [https://perma.cc/SDD6-FCFR].

115. Asher-Schapiro & Baptista, *supra* note 104.

116. *Data Protection Laws of the World: Data Protection in the United States*, DLA PIPER, https://www.dlapiperdataprotection.com/?t=definitions&c=US [https://perma.cc/3XF9-SQYK] (last updated Feb. 6, 2025).

1996[117] ("HIPAA") establishes national standards to protect certain health-related personal information from being disclosed without the patient's consent or knowledge.[118] Other examples of such "limited application" federal privacy laws include: the Fair Credit Reporting Act[119] ("FCRA"), which governs the use of personal information used in consumer reports sold for purposes of determining eligibility for credit, employment, and insurance underwriting; the Gramm-Leach-Bliley Act of 2002[120] ("GLBA"), which applies to personal information collected, used, and disclosed by financial institutions; the Family Educational Rights and Privacy Act[121] ("FERPA"), which addresses the privacy of students' educational records; and the Children's Online Privacy Protection Act[122] ("COPPA"), which imposes certain requirements on web platforms or online services directed at children under thirteen years of age.

On the state level, approximately twenty states have enacted their own version of comprehensive privacy laws, creating a patchwork quilt of statutes with varying degrees of protections and conflicting definitions of what is considered "personal data."[123] Although some state laws are similar in scope to their federal counterparts like HIPAA and the FCRA, there is considerable diversity in the scope, mandates, and even enforcement frameworks of these laws. For example, although most state privacy laws are enforceable only by the state attorney general or by a given state regulatory body, the Illinois Biometric Information Privacy Act[124] ("BIPA") provides a private right of action for violations. BIPA regulates the collection, storage, and use

117. Health Insurance Portability and Accountability Act, Pub. L. 104-91, 110 Stat. 1936 (1996).

118. *See id. passim.*

119. Fair Credit Reporting Act, 15 U.S.C. §§ 1681–1681x (1970).

120. Gramm-Leach-Bliley Act, Pub. L. 106-102, 113 Stat. 1338 (2002).

121. Family Educational Rights and Privacy Act, 20 U.S.C. § 1232g (1974).

122. Children's Online Privacy Protection Act, 15 U.S.C. §§ 6501–6506 (2000).

123. Philip N. Yannella & Tim Dickens, *New State Privacy Laws Creating Complicated Patchwork of Privacy Obligations*, REUTERS (June 7, 2024, 1:19 PM EDT), https://www.reuters.com/legal/legalindustry/new-state-privacy-laws-creating-complicated-patchwork-privacy-obligations-2024-06-07/ [https://perma.cc/TF7M-H2X3 (staff-uploaded)].

124. Illinois Biometric Information Privacy Act, 740 ILL. COMP. STAT. 14/1 to 14/99 (2008).

and sale of an individual's biometric information used to identify them—such as facial geometry, fingerprint, voiceprint, hand scan, or retinal or iris scan.[125] In addition, there are privacy regulations in non-privacy statutes.[126] As a result, in many states, Americans have provisions that govern such subjects as employee privacy, collection of driver's license or Department of Motor Vehicles data, call and video recording, and even geolocation tracking.

B. Colorado

On April 17, 2024, Colorado made history by becoming the first state in the country to pass a neural privacy law, Colorado House Bill 24-1058[127] (the "Colorado Neural Privacy Law"), which expanded the protections of individuals' biological data by encompassing neural data.[128] The new law expanded the safeguards and definitions already contained in the Colorado Privacy Act[129] ("CPA"), which itself had been groundbreaking. To better understand and appreciate the significance of this neural privacy law, it is helpful to know some background information about the CPA.

1. The CPA, Generally

The CPA went into effect in July of 2023 as part of a wave of state privacy acts passed that year.[130] Made as part of Colorado's Consumer

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125. *See generally id.* Illinois, along with Texas and Washington, are the only states with "standalone" biometric privacy laws. *See generally id.*; Texas Capture or Use of Biometric Identifier Act, TEX. BUS. & COM. CODE § 503.001 (2009); Washington Biometric Privacy Act, WASH. REV. CODE §§ 19.375.010 to .900 (2017).

126. See, for example, the Gramm-Leach-Bliley Act ("GLBA"), Pub. L. 106-102, 113 Stat. 1338 (2002), which regulates financial institutions and which includes privacy provisions; the Health Insurance Portability and Accountability Act ("HIPAA"), Pub. L. 104-91, 110 Stat. 1936 (1996); and the Federal Trade Commission Act ("FTCA"), 15 U.S.C. 41–58.

127. Protect Privacy of Biological Data, 2024 Colo. Legis. Serv. Ch. 68 (H.B. 24-1058) (codified as amended at COLO. REV. STAT. § 6-1-1303) (effective July 1, 2025)).

128. *Id.*

129. Colorado Privacy Act, COLO. REV. STAT. §§ 6-1-1301 to -1313 (2025).

130. Heather Morton, *2023 Consumer Data Privacy Legislation*, NAT'L CONF. ST. LEGISLATURES (Sept. 28, 2023) (identifying eight states that enacted

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Protection Act,[131] the CPA grants state consumers new rights with respect to their personal data and imposes new obligations on those entities covered by the law to safeguard personal data.[132] Most significantly, the CPA provides consumers with the right to "access, correct, and delete personal data," as well as the right to opt out of the sale or collection and use of personal data.[133] The law also imposes affirmative obligations on companies to safeguard personal data and provide "clear, understandable, and transparent" information to consumers about how their personal data is used.[134]

The CPA applies to legal entities that are either conducting business in Colorado or producing commercial products and services intentionally targeted at Colorado residents.[135] In addition, the entities in question must either (1) control or process the personal data of at least 100,000 consumers per calendar year or (2) derive revenue from the sale of personal data of at least 25,000 consumers.[136]

Under the CPA, a "controller" is defined as the entity that—alone or jointly with others—determines the purposes and means of processing personal data.[137] The statute imposes multiple obligations on controllers. These obligations include: providing consumers with a reasonably accessible, clear, and meaningful privacy notice; specifying the express purpose for which personal data will be collected and processed; collecting only personal data that is relevant and limited to what is "reasonably necessary in relation to the specified purpose"; avoiding "secondary uses" of personal data that are not reasonably necessary or compatible with the specified purpose; taking "reasonable measures" to secure personal data; avoiding any processing of personal data that might be in violation of federal antidiscrimination laws;

"comprehensive consumer privacy laws" in 2023), https://www.ncsl.org/technology-and-communication/2023-consumer-data-privacy-legislation [https://perma.cc/4SH5-6N23 (staff-uploaded)].

131. Colorado Consumer Protection Act, COLO. REV. STAT. §§ 6-1-101 to -1707 (2025).

132. *See generally* COLO. REV. STAT. § 6-1-1301.

133. *Id.* § 6-1-1302(1)(c).

134. *Id.*

135. *Id.* § 6-1-1304.

136. *Id.*

137. *Id.* § 6-1-1305(7).

conducting data protection impact assessments of "high risk" processing activities like targeted advertising; and entering into data processing agreements with processors or service providers.[138]

The CPA also imposes obligations on the processors themselves. The statute defines a "processor" as the entity that processes personal data on behalf of a controller.[139] Under the law, processors follow the controller's instructions for processing; assist the controller with responding to consumers and with security (including data breach notifications); enter into a data processing agreement with the controller; maintain data confidentiality; delete or return data to the controller at the conclusion of services; and demonstrate their compliance with any audits requested by the controller.[140]

The CPA was modeled on Virginia's data privacy act[141] and contains similarities to California's Consumer Privacy Act[142] ("CCPA"). Beyond its broad applications, the CPA created a subset of personal data called "sensitive data." Sensitive data was defined as "personal data revealing racial or ethnic origin, religious beliefs, a mental or physical health condition or diagnosis, sex life or sexual orientation, or citizenship or citizenship status," as well as "genetic or biometric data that may be processed for the purpose of uniquely identifying an individual" or "personal data from a known child."[143]

2. Neural Privacy Updates to the CPA

The primary significance of Colorado's neural privacy law, House Bill 24-1058, is its expansion of the CPA's definition of "sensitive data." Under this newly amended CPA, "sensitive data" now includes "biological data" and "neural data."[144] The statute defines "biological

138. *Id.* § 6-1-1308.

139. *Id.* § 6-1-1303(19).

140. *Id.* § 6-1-1305.

141. Virginia Consumer Data Protection Act (VCDPA), VA. CODE §§ 59.1-575 to -584 (effective Jan. 1, 2023).

142. California Consumer Privacy Act (CCPA), CAL. CIV. CODE §§ 1798.100 to 1798.199.100 (2020).

143. COLO. REV. STAT. § 6-1-1303 (2023) (as written prior to 2024 neural privacy amendment).

144. Protect Privacy of Biological Data, 2024 Colo. Legis. Serv. Ch. 68 (H.B. 24-1058) § 1 (codified as amended at COLO. REV. STAT. § 6-1-1303) (effective July 1, 2025)).

data" as data that is "generated by the technological processing, measurement, or analysis of an individual's biological, genetic, biochemical, physiological or neural properties, compositions, or activities, or of an individual's body or bodily functions, which data is used or intended to be used, singly or in combination with other personal data, for identification purposes."[145] "Neural data," a subset of biological data, is defined as "information that is generated by the measurement of the activity of an individual's central or peripheral nervous systems and that can be processed by or with the assistance of a device."[146]

Significantly, Colorado's neural privacy law does not change the exemptions or exceptions that apply to the CPA more broadly. For example, the statute exempts matters that federal medical privacy law would address.[147] As a result, the "devices" referenced in Colorado's definition of neural data would not include invasive tools like cochlear implants, which fall under the purview of HIPAA. Instead, the "devices" targeted by the statute would apply to noninvasive, consumer-grade devices readily available on ecommerce platforms—devices like gaming headsets or wellness headbands, which collect neural data but are not subject to medical privacy regulations.

Similarly, because the CPA's definition of "consumer" remains unchanged, it applies only to Colorado residents acting in an individual or household context—not individuals acting in commercial or employment scenarios, such as job applicants.[148] Consequently, because the CPA and its newly added neural data provision will not apply to employee or job applicant data, employers looking to use neurotechnology to track issues like employee inattention, burnout, and biases will not fall under the purview of Colorado's law.

145. COLO. REV. STAT. § 6-1-1303 (effective July 1, 2025).
146. *Id.*
147. *Id.*
148. *Id.*

This is important because companies are already bringing neurotechnology into the workplace.[149] While wearable devices that monitor brain activity can offer helpful monitoring in professions that demand sustained attention, such as air traffic control, they also run the risk of potential misuse of brain data, or even a data breach. Neural data could also be leveraged for discrimination or unfair employment decisions. Whereas employees are safeguarded against such biases based on *genetic* data thanks to the Genetic Information Nondiscrimination Act[150] ("GINA"), no such similar protection exists for those whose *neural* data might be used against them.[151]

Nor is this risk far-fetched. Imagine an employer using noninvasive wearable devices like an EEG to examine brain activity for a position requiring certain skills. Could such data be used for more nefarious purposes, like a form of lie detection? Just ask Brendan Baker. In 2023, the Massachusetts man filed a class action lawsuit against CVS for making applicants take what amounted to lie detector tests during the interview process without notice.[152] According to the suit, Baker and others submitted to video interviews that CVS had analyzed by a company called HireVue.[153] Using AI analysis provided by an algorithm developed by Affectiva, HireVue would track facial expressions like "smiles, surprise, contempt, disgust, and smirks" before assigning applicants an "employability score" that analyzed traits like "conscientiousness" and whether a job candidate had or

149. Ronnie Dungan, *Is Brainwave Monitoring Really Coming to Your Workspace and Is It . . . a . . . Good Thing?*, HRGRAPEVINE.COM (Jan. 15, 2025), https://www.hrgrapevine.com/us/content/article/2025-01-10-is-brainwave-monitoring-really-coming-to-your-workspace-is-that-a-good-thing [https://perma.cc/7K7R-J9E9 (staff-uploaded, dark archive)].

150. Genetic Information Nondiscrimination Act of 2008, Pub. L. 110-233, 122 Stat. 881 (2008).

151. Dungan, *supra* note 149.

152. Carolyn Crist, *CVS Settles Lawsuit Alleging It Use AI "Lie Detector" in Interviews*, HRDIVE (July 24, 2024), https://www.hrdive.com/news/cvs-settles-lawsuit-over-using-ai-based-lie-detector/722249 [https://perma.cc/W2D5-TFVL]; *see generally* Notice of Removal, Baker v. CVS Health Corp., 717 F. Supp. 3d 188 (D. Mass. June 30, 2023) (No. 1:23CV11483), ECF No. 1 (text of complaint contained within notice of removal document).

153. Notice of Removal at 3–4, Baker, 717 F. Supp. 3d 188 (No. 1:23CV11483) (text of complaint contained within notice of removal document).

lacked an "innate sense of integrity and honor."[154] After CVS's failed efforts to dismiss the lawsuit, it was settled in July of 2024.[155]

Employee consent presents another legal issue in the employment arena. Neurotechnology might offer training benefits through techniques like transcranial electrical stimulation that could enhance learning and motor skills.[156] But could an employer make it mandatory to use such techniques or wear this technology? If employees refuse to participate, would they suffer adverse employment decisions like suspension, reassignment, or even termination (or in the case of a job candidate, a denied or rescinded job offer)? The potential for abuses of neural data in the workplace abound.

In 2023, the Information Commissioner's Office ("ICO"), a watchdog group, issued a report outlining how the increasing use of neural data and neurotechnology in the workplace could pose "numerous risks and challenges for data protection."[157] Among these, the report concluded, was the risk that "[c]onclusions drawn from information may be based in highly contested definitions and scientific analysis of traits," which may "embed systemic bias" and result in discrimination.[158] To combat this, the report added, employers would need to consider "fairness, transparency and data retention."[159]

Beyond the CPA's employment exemption, another exemption applies to publicly available information. This includes information a consumer has intentionally made available online, where the individual "has not restricted the information to a specific

154. *Id.* at 5–6.

155. Crist, *supra* note 152.

156. *Neurotechnology in HR: Elevating Employee Well-Being and Performance*, HRTECH CUBE (Feb. 10, 2025), https://hrtechcube.com/neurotechnology-in-hr-employee-wellbeing-performance [https://perma.cc/6HYC-U6K5].

157. *ICO Tech Futures: Neurotechnology, Sector Scenarios*, INFO. COMM'R'S. OFF., https://ico.org.uk/about-the-ico/research-reports-impact-and-evaluation/research-and-reports/technology-and-innovation/ico-tech-futures-neurotechnology/sector-scenarios [https://perma.cc/K47Q-YBMW] (last visited Apr. 8, 2025).

158. *Id.*

159. *Id.*

audience."[160] If a neurotechnology company—such as one that makes wearable devices, like headbands or earbuds—allows consumers to post images of their collected brainwaves to a social media page, that neural data conceivably falls outside the scope of Colorado's neural privacy laws. And while posts to a personal social media page may be restricted to a specific audience, such as "friends only" posts, they can nevertheless be very public, or reshared publicly by one's "friends."

Colorado's neural policy privacy act, in its preamble, recognizes that "[o]ngoing advances in technology have produced exponential growth in the volume and variety of personal data being generated, collected, stored, and analyzed," and that such advances present "both great promise and potential risks."[161] It also recognizes that neurotechnologies raise "particularly pressing privacy concerns given their ability to monitor, decode, and manipulate brain activity."[162] Because every human brain is unique, the statute noted, neural data is "extremely sensitive" and can reveal intimate information "about health, mental states, emotions, and cognitive functioning" that will necessarily link the data "to an identified or identifiable individual."[163]

Although the CPA refers to neurotechnology and describes it as including "devices capable of recording, interpreting, or altering the response of an individual's central or peripheral nervous system," it does not provide a definition of "neurotechnology."[164] This begs the question: Was the CPA's purpose to regulate devices and data or to address the threat to privacy? On one hand, the statute *does* go to some pains to distinguish between neurotechnologies that are "deployed in medical settings," and therefore are "regulated by health data privacy laws," and those that are "generally considered consumer products and operate without regulation or data protection standards."[165] On the other hand, the codification of the neural privacy laws as part of an amended CPA (and the absence of a clear definition of

160. Colorado Privacy Act, COLO. REV. STAT. §§ 6-1-1301 to -1313 (2023).

161. Protect Privacy of Biological Data, 2024 Colo. Legis. Serv. Ch. 68 (H.B. 24-1058) § 1(2)(a) (codified as amended at COLO. REV. STAT. § 6-1-1303) (effective July 1, 2025).

162. *Id.* § 1(2)(c).

163. *Id.* § 1(2)(d)–(e).

164. *Id.* § 1(2)(c).

165. *Id.* § 1(2)(i).

neurotechnology) indicates that, while legislators may have been motivated by regulating neurotechnology, the focus wound up being the privacy harm rather than the devices or data themselves.

There are other ambiguities in the CPA. One is whether the CPA applies to all neural data or only neural data used for identification purposes. The CPA's definition of "neural data" is not expressly limited to data used for identification purposes,[166] which may lead some to believe it encompasses all neural data, regardless of how it is used. However, "biological data," by its definition, encompasses only data that will be used for identification purposes.[167] Because "neural data" is clearly placed as a subset of biological data, one could argue that "neural data" too encompasses only data used for identification purposes. Such a reading, though, would narrow the effect of the CPA, excluding the varieties of neural data collected for nonidentification reasons, such as for tracking attention rates.

As a result, it is unclear whether neural data includes both the raw data collected from an individual's nervous system (such as an EEG) and the inferences and conclusions that are drawn from processing such data. Simply put, does neural data trigger the CPA's protections whenever it is collected or only when it is "intended to be used for identification purposes?"[168]

Another ambiguity is whether the CPA's coverage extends to *inferences* made from neural data or is limited to only the neural data itself. For example, the ICO report mentioned earlier in this Section describes neural data as consisting not only of the initial signal or data collected from a person's neural system, as recorded by a device, but also the *interpretation* of that data (or as the ICO report characterizes it, "second order inferences based directly on this data").[169] The CPA, however, is unclear as to whether inferences obtained from the processing of neural data are intended to be treated as information generated from neural activity. If courts or regulatory bodies interpreting the CPA decide that inferences are not included as a part

166. Colorado Privacy Act, COLO. REV. STAT. § 6-1-1303(16.7) (effective October 1, 2025).

167. *Id.* § 6-1-1303(2.2) (effective October 1, 2025).

168. *Id.*

169. *ICO Tech Futures: Neurotechnology, Sector Scenarios*, *supra* note 157.

of neural data, companies may be free to use the conclusions drawn from raw neural data for various business purposes that fall outside the scope of the statute.

A final question worth noting about the CPA deals with the issue of informed consent. The preamble to the statute points to doubt on the part of lawmakers as to whether effective informed consent to process neural data can ever be obtained. It states, "[e]ven if individuals consent to the collection and processing of their [neural] data for a narrow use, they are unlikely to be fully aware of the content or quantity of information they are sharing."[170] In the CPA itself, consent is acquired through "clear affirmative action" (deliberate conduct or a statement that indicates acceptance of the proposed processing) that is "freely given," "specific" to each processing purpose, and "informed" (which requires explaining the reason consent is required and the purposes for which the data will be processed).[171] While it remains to be seen whether further "neural data-specific" requirements for obtaining valid consent need to be added to the CPA in the future, both the complexity of the data itself and its boundless potential for future use make it likely that questions about effective informed consent will crop up.

In short, Colorado's neural privacy law is a bold step and a significant milestone in charting the expanding frontier of data privacy law. However, important ambiguities remain. Moreover, the Colorado law presents critical departures from other state efforts at adopting neural privacy legislation, as this Article explores.

C. California

In September of 2024, Meta held its Meta Connect 2024 conference where it offered "sneak peeks" at new products.[172] Among the notable

170. Protect Privacy of Biological Data, 2024 Colo. Legis. Serv. Ch. 68 (H.B. 24-1058) § 1 (codified as amended at COLO. REV. STAT. § 6-1-1303) (effective July 1, 2025).

171. COLORADO PRIVACY ACT, Colo. Rev. Stat. §§ 6-1-1301 to -1313 (2023).

172. *Meta Connect 2024*, META (Sept. 25–26, 2024), https://www.meta.com/connect/ [https://perma.cc/JE66-W9B2 (staff-uploaded).

additions was its new smart glasses product called "Orion."[173] Those operating the Orion glasses would do so by using a neural interface built into a separate wristband and external computing device.[174] The wristband's neural interface apparently employs electromyography ("EMG") technology, enabling users to—as Mark Zuckerberg described—"just send a signal from your brain" to the smart glasses.[175]

Only three days later, California Governor Gavin Newsom signed into law Senate Bill 1223[176] ("SB 1223"), a piece of legislation that declared neural data as a new type of information that would be protected under California's comprehensive data privacy law, the CCPA.[177] California thus became only the second state to enact a neural privacy law, following in Colorado's footsteps. Like Colorado, California did so by amending its existing data privacy statute. And much like Colorado's law, California's law added neural data to a preexisting list of protected "sensitive personal information."[178]

SB 1223 defines neural data similar to Colorado's definition: "information that is generated by measuring the activity of a consumer's central or peripheral nervous system, and that is not inferred from nonneural information."[179] SB 1223 and the larger provisions of the CCPA are very similar to the CPA. One key difference is in the definition of the businesses to whom it applies. The CCPA applies to for-profit businesses with an annual gross income of $25 million or more if the business buys, sells, or shares the personal information of at least 100,000 California residents or households, or if the business derives at least fifty percent of its annual revenue from

173. Kyle Wiggers, *Meta Developed a "Neural Interface" for Its Next-Gen Orion AR Glasses*, TECHCRUNCH (Sept. 25, 2024), https://techcrunch.com/2024/09/25/meta-developed-a-neural-interface-for-its-next-gen-orion-ar-glasses/ [https://perma.cc/D946-JUH7].

174. *Id.*

175. *Id.*

176. S.B. 1223, 2023–2024 Leg., 2024 Cal. Stat. ch. 887 (2024) (codified as amended at CAL. CIV. CODE § 1798.140(ae)(1)(G)(ii)).

177. *See* CAL. CIV. CODE § 1798.140; Jessica Hamzelou, *California Passes Law to Protect Consumer "Brain Data"*, MIT TECH. REV. (Oct. 4, 2024), https://www.technologyreview.com/2024/10/04/1104972/law-california-protects-brain-data-doesnt-go-far-enough/ [https://perma.cc/3M7R-VS3R].

178. California Consumer Privacy Act, CAL. CIV. CODE § 1798.100 to 1798.199.100.

179. *Id.* § 1798.140(ae)(1)(G)(ii).

selling California residents' personal information.[180] By contrast, the Colorado Act is not limited to for-profit businesses, and does not have a $25 million threshold, but rather a "100,000 consumers" threshold.[181]

Like its Colorado counterpart, the CCPA adds protection of neural data to the protections it affords to other sensitive information, such as a consumer's genetic data, biometric data, "precise geolocation" data, and credentials needed to access a consumer's financial accounts.[182] In addition, as with the Colorado law, neural data from invasive or implanted neurotechnologies (such as medical devices) is exempted from the CCPA because these devices are generally already subject to medical privacy laws like HIPAA.[183] Also consistent with Colorado protections, the protections available under the California law include the right to know what brain data is being collected, the right to limit its disclosure, and the right to opt out or to have the data deleted.[184]

Jared Genser, general counsel to the Neurorights Foundation (a cosponsor of SB 1223), applauded the law. He stated that the new law "will make the lives of consumers safer while sending a clear signal to the fast-growing neurotechnology industry that there are high expectations that companies will provide robust protections for mental privacy of consumers."[185] The law's lead sponsor, California state Senator Josh Becker, called it a win and declared that "[r]egulating neurotechnology early in its development is essential to ensure ethical use, protect privacy, establish industry standards, and address future implications."[186]

However, California's neural privacy law also raises questions and potential concerns. By defining "neural data" as it did and treating it as an object worthy of regulation, the statute may have created three

180. *Id.* § 1798.100(a).

181. *Id.* § 1798.100.

182. *Id.*

183. *Id.*

184. *Id.*

185. Hamzelou, *supra* note 177.

186. Press Release, Senate Overwhelmingly Approves Nation's Strongest Neurorights Bill, Office of Sen. Josh Becker (May 21, 2024), https://sd13.senate.ca.gov/news/press-release/may-21-2024/senate-overwhelmingly-approves-nations-strongest-neurorights-bill [https://perma.cc/636F-NFCM].

new classes of data: (1) data from the central nervous system—the brain and spinal cord; (2) data from the peripheral nervous system—the nerves extending from the brain and spine; and (3) "nonneural" data. California's law does not provide any definition for any subcategories. Will there be uncertainty or confusion about what neural data the law actually covers and how that data will be treated? What was the intent of the statute?

The text of the legislation certainly focuses on data. Taking Senator Becker's press release at face value, however, seems to indicate that the goal of SB 1223 was to regulate "neurotechnology," rather than data.[187] Indeed, an earlier version of Becker's bill had a different definition of neural data, describing it as "information . . . that can be processed by, or with the assistance of, neurotechnology."[188] This older version went on to define neurotechnology as devices or instruments that allow for "reading, recording, or modifying a persons [sic] brain activity or the information obtained from a persons [sic] brain activity."[189] No explanation has ever been given for why SB 1223's final version omits this definition of neurotechnology. Also, no explanation was given as to why it would have made any difference (for data protection purposes) that neurotechnologies can modify brain activity.

What were the policy objectives of California's neural privacy legislation? Unlike Colorado's neural privacy law, which starts out with a statement of the law's purposes and why the need for the law is so acute, California's legislation offers no such illumination. Interestingly, industry groups like the California Chamber of Commerce were opposed to the legislation on the grounds that "information about activity of the [peripheral nervous system] simply is not capable of revealing someone's inner thoughts and mental processes, which this bill seeks to protect."[190]

187. *Id.*

188. *SB 1223: Consumer Privacy: Sensitive Personal Information: Neural Data*, CALMATTERS (Sept. 28, 2024), https://calmatters.digitaldemocracy.org/bills/ca_20232024sb1223 [https://perma.cc/TD9S-WSJZ].

189. *Id.*

190. *Id.*

So where does California's law leave a product like Meta's Orion, which certainly seems likely to fall under the category of collecting data from the peripheral nervous system? Should its data be treated like data from the central nervous system? Regulators interpreting the law will have the unenviable task of navigating these uncertain legal, scientific, and policy boundaries.[191]

The California law has been criticized for its distinction between neural data that can only be collected by invasive medical-grade neurotechnologies and the less sensitive, non-neural inferential data captured from outside the body. Nita Farahany, a professor of law and ethics at Duke University, considers both the California and Colorado definitions of neural data as overly ambiguous, saying these laws should be broadened to cover what she calls "cognitive biometrics" and to protect "cognitive liberty."[192] As Farahany points out, brain activity is not the only thing that can betray how one is feeling.[193] Upticks in heart rate might indicate excitement or stress, as fitness trackers can demonstrate. Eye-tracking devices might give away a consumer's intentions, such as a selection she will likely make or a product she might decide to buy.

Farahany points to various situations where such data has been used to reveal information that might otherwise be extremely private.[194] For example, EEG data has been used to predict such intimate details in study volunteers as their sexual orientation or

191. Unlike the Colorado neural privacy law, which will be enforced by the Colorado Attorney General's Office, California's law will be enforced by a regulatory body, the California Privacy Protection Agency. The California Privacy Rights Act, which amends the California Consumer Privacy Act found in Title 1.81.5 of the California Civil Code, grants the California Privacy Protection Agency "full administrative power, authority, and jurisdiction to implement and enforce the CCPA." CAL. CIV. CODE § 1798.199.10(a) (West).

192. *See generally* FARAHANY, *supra* note 19.

193. Farahany, *supra* note 19, at 43–45 (discussing keystroke monitoring to assess productivity and telematic technology to infer drowsiness); Jonathan Moens, *California Passes Law Protecting Consumer Brain Data*, N.Y. TIMES (Sept. 21, 2024), https://www.nytimes.com/2024/09/29/science/california-neurorights-tech-law.html [https://perma.cc/Y5A6-2H6A (staff-uploaded, dark archive).

194. *Id.*

whether they use recreational drugs.[195] Because of this, Farahany argues that laws like California's and Colorado's should be broadened to embrace the concept of "cognitive liberty," which she defines as "the right to self-determination over our brain and mental experiences: the right to access information and the right to change our brains if we choose—whether that's to enhance or diminish them, to have a glass of wine, or decide to go to law school."[196]

D. Minnesota

Minnesota deserves recognition among the ranks of states proposing and eventually passing neural privacy laws, even though it currently has no such law. It is not for lack of trying; state Senator Eric Lucero has been trying to pass such legislation since 2020 with little progress.[197] In 2023, Minnesota considered House File 1904[198] ("H.F. 1904") relating to data privacy and establishing "neurodata rights." In stark contrast to its counterparts in California and Colorado, Minnesota's law did not purport to amend an existing state data privacy statute; instead, it was a standalone bill.

The legislation would have first established rights to "mental privacy" and "cognitive liberty."[199] It would have prohibited government entities from collecting data transcribed directly from brain activity without having informed consent or from interfering with an individual's "free and competent decision making" when making neurotechnology decisions.[200] The bill also would have required that each time an individual connected to a BCI, the company responsible for recording and storing the data would need to

195. *Id.*; *see also* Katrin T. Lübke, Dunja Storch, & Bettina M. Pause, *Sexual Orientation Affects Neural Response to Subtle Social Aggression Signals*, 53 ARCHIVES OF SEXUAL BEHAVIOR 153, 155 (2024).

196. Paul W. Grimm & Nita A. Farahany, *The Battle for Your Brain: A Legal Scholar's Argument for Protecting Brain Data and Cognitive Liberty*, 107 JUDICATURE 3, 47 (2024).

197. Skye Witley, *Brain-Scanning Technology Spurs State Moves on Neural Privacy*, BLOOMBERG L. (Feb. 13, 2024), https://news.bloomberglaw.com/privacy-and-data-security/brain-scanning-technology-spurs-state-moves-on-neural-privacy [https://perma.cc/FFR7-ARW2].

198. H.F. 1904, 93rd Leg. (Minn. 2024).

199. *Id.* § 1(b).

200. *Id.* § 1(b).

provide notice of what the data may be used for.[201] That company would also have been required to give notice of the third parties with which the data would be shared.[202] Informed consent would have been required each time an individual connected to a BCI, and such consent would have been mandatory for each use and each third party before the data could be used or shared.[203] Companies violating these provisions would have been subject to a civil penalty of up to ten thousand dollars per incident.[204]

The most intriguing aspects of Minnesota's proposed neural privacy legislation, however, rested with its definitions and declarations of "neurotechnology rights," rather than mundane data collection questions.[205] The bill defined "neurotechnology" as "the assembly of methods and instruments that enable a direct connection of technical components with the nervous system."[206] It also introduced readers to the concept of a "consciousness bypass," which it defined as "the use of neurotechnology to manipulate brain activity by applying electrical or optical stimuli without the conscious awareness of the person whose brain activity is being manipulated."[207] The draft legislation went on to prohibit a company from using a BCI to bypass an individual's conscious decision-making.[208]

The bill also made an ambitious declaration of "neurotechnology rights." The legislation stated that "[a]n individual has the right to change one's decisions regarding neurotechnology," as well as the "right to determine by what means to change that decision."[209] It continued, stating that "[a]n individual has the right to mental integrity and is afforded protection from neurotechnological interventions of the mind and from unauthorized access to or manipulation of an individual's brain activity."[210] Finally, the bill provided that an

201. *Id.* § 2(c).
202. *Id.*
203. *Id.* § 1(a).
204. *Id.* § 2 subdiv. 5.
205. *Id.* § 1 subdiv. 1a(a).
206. *Id.*
207. *Id.* § 2 subdiv. 1(c).
208. *Id.* § 2 subdiv. 4(a).
209. *Id.* § 1 subdiv. 1a(a).
210. *Id.* § 2 subdiv. 2(b).

individual has the right to "psychological continuity," and is afforded "protection from unauthorized neurotechnological alterations in mental functions critical to personality."[211]

Whether or not due to its sweeping language, Minnesota's bill stalled in committee for over a year and did not advance.[212] Its proponents, however, are bullish on the prospects for future success. As state Senator Lucero characterized it, now is the time to get such legislation passed while neurotechnology is still in a comparatively nascent stage. He stated that "[i]t is a lot easier to get controls and limitations in place before a technology is widely adopted, rather than trying to do so after a technology is widely adopted and in use."[213]

V. THE FUTURE OF NEURAL PRIVACY LAW? A MODEST PROPOSAL

In 2022, famed director Werner Herzog released a documentary, entitled *Theatre of Thought*, in which he examined the moral and ethical implications of neurotechnology—focusing in part on the work of neurobiologist Rafael Yuste.[214] A review of the film called it "a bracing exploration" of the "brave new world of [BCIs]."[215] Critic Sheri Linden summarized neurotechnology's "chilling" potential consequences: "When computers can extract information directly from the brain or feed commands straight into it, privacy, autonomy and the very sense of self are at stake."[216]

More jurisdictions will likely follow the lead of Colorado and California in protecting brain wave data. Case law will emerge as ethical issues and constraints similarly arise. The question of regulation will continue to be pressing as neurotechnology steadily migrates from the realm of medicine and regulated medical devices to

211. *Id.* § 2 subdiv. 2(c).

212. Witley, *supra* note 197.

213. *Id.*

214. *Theatre of Thought*, IMDB, https://www.imdb.com/title/tt21998502/ [https://perma.cc/M2XY-BQTK] (last visited Apr. 28, 2025).

215. Sheri Linden, *"Theatre of Thought" Review: Werner Herzog Crafts a Bracing Exploration of Neurotechnology and Consciousness*, HOLLYWOOD RPTR. (Sept. 9, 2022), https://www.hollywoodreporter.com/movies/movie-reviews/theater-of-thought-review-werner-herzog-doc-telluride-1235202736/ [https://perma.cc/YEA4-F4QC].

216. *Id.*

everyday consumer products. But neural data is capable of revealing very intimate information about consumers, including their mental states and emotions. These capabilities, even for noninvasive devices, will only grow in the years to come. The sensitivity of neural data and the privacy risks posed to neurotechnology consumers make protection of this data imperative. As one leading scholar has warned, "[w]e also need national legislation in many different parts and subparts."[217]

Attempts have been made to give Americans a national data privacy law. The most recent example, the American Privacy Rights Act of 2024[218] ("APRA"), is a bipartisan piece of legislation that would create a comprehensive federal privacy framework and provide a mechanism for individuals to request that data brokers delete their personal information.[219] It would even go further than a number of state privacy laws: It would define "sensitive covered data" to include not only health information and financial data, but also genetic information, biometric identifiers, and precise geolocation information.[220] However, the APRA would not address neural data specifically, and it has not been passed.

In the absence of a general federal data privacy law that encompasses neural privacy among other types, the next best alternative is a federal law that focuses solely on neural privacy. What might such a law look like? A useful analogy is GINA, which prohibits discrimination based on genetic information by health insurers and employers.[221] Enacted in 2008, GINA is an example of preemptive legislation. As lawmakers took note of technological advances like the sequencing of the human genome and the progress in genetic therapies to cure diseases, they also saw the potential downside. An employer or health insurer could decide to take adverse action based on an individual's genetic predisposition to disease. GINA was enacted not

217. Grimm & Farahany, *supra* note 196, at 48.

218. *The American Privacy Rights Act*, CONG. RESEARCH SERV. 1 (May 31, 2024), https://www.congress.gov/crs_external_products/LSB/PDF/LSB11161/LSB11161.2.pdf [https://perma.cc/S65A-BPF7].

219. *Id.* at 2.

220. *Id.*

221. Genetic Information Nondiscrimination Act, Pub. L. No. 110-233, 122 Stat. 881 § 101 (2008) (codified in various sections of 26, 29, and 42 U.S.C.).

only with the hope that it would "allay public fears of genetic discrimination that discouraged people from undergoing genetic testing and participating in genetics research"; it had another problem in mind as well.[222]

GINA also "created uniform protections to remedy a confusing patchwork of state and federal protections."[223] Despite these protections, in the wake of increased availability and dissemination of vast amounts of personally relevant information, issues have persisted. One issue has been the inconsistent interpretation of the law in courts around the country, particularly on what constitutes "genetic information."[224] Some courts have adopted a narrower interpretation. The court that decided *Poore v. Peterbilt Bristol, L.L.C.*,[225] for example, reasoned that information about a disease or disorder in family members is not "genetic information" if such information is taken into account only with respect to the family member with the condition.[226] Other courts have construed "genetic information" broadly and in a manner consistent with the statutory language. In *Jackson v. Regal Beloit America*,[227] the court concluded that an employer unlawfully requested protected "genetic information" when it sought medical records with family history.[228]

Besides inconsistent interpretation by courts, another criticism of GINA has been the complaint that—perhaps because it is limited to health insurance and employment contexts—it does not go far enough. Scholars have lamented that while GINA addresses the threat of genetic discrimination in the workplace, the Act does nothing to prohibit discrimination in life insurance, disability insurance, long-

222. Sonia Suter, *GINA at 10 Years: The Battle Over "Genetic Information" Continues in Court*, 5 J.L. & BIOSCIENCES 495, 495 (2019).

223. *Id.*

224. *Id.*

225. 852 F. Supp. 2d 727 (W.D. Va. 2012).

226. *Id.* at 727 (holding no discrimination under GINA where the husband-employee was terminated following his disclosure of his wife's multiple sclerosis diagnosis).

227. No. 16-134, 2018 WL 3078760 (E.D. Ky. June 21, 2018).

228. *Id.* at *15.

term care insurance, mortgages, or commercial transactions.[229] Other observers have pointed out that GINA fails to address genetic discrimination in such areas as public education or housing.[230] The existence of such perceived gaps in GINA led states like California to pass genetic antidiscrimination laws to provide broader protections in areas like these.[231]

The rise—and fall—of consumer genetic testing company 23andMe illustrates the need for greater privacy protections for something as uniquely personal as one's DNA or neural data. Founded in 2006, 23andMe was once a thriving company valued at $6 billion.[232] After unprecedented success in amassing one of the biggest DNA collections in the world (at least fifteen million people are in its database),[233] the home-testing giant has lost 99.9% of its value.[234] Most of the company's board resigned in September of 2024, and in November, the company cut 40% of its workforce.[235] In 2023, 23andMe suffered a major data breach, which it settled for $30 million.[236] As the company continues its downward spiral, many observers (and presumably millions of consumers) are left to ponder what will happen to consumers' genetic data. The answer is unclear, but given the ever-increasing quantities of neural data being collected worldwide and the proliferation of

229. Michael R. Dohn, *Personal Genomics and Genetic Discrimination: Is Increased Access a Good Thing?*, 45 WEST. ST. L. REV. 2, 126 (2018).

230. *See, e.g.*, Sarah Zhang, *The Loopholes in the Law Prohibiting Genetic Discrimination*, ATLANTIC (Mar. 13, 2017), https://www.theatlantic.com/health/archive/2017/03/genetic-discrimination-law-gina/519216/ [https://perma.cc/JM9M-5DUV].

231. *See, e.g.*, California Genetic Information Nondiscrimination Act (CalGINA), SB 559 (Jan. 1, 2012).

232. Diana Kwon, *What Went Wrong at 23andMe? Why the Genetic-Data Giant Risks Collapse*, NATURE, Feb. 6, 2025, at 14, 14.

233. *Id.*

234. Bobby Allyn, *23andMe Is in Trouble. What Happens to All the DNA Data?*, NPR (Sept. 25, 2024, 4:21 PM ET), https://www.npr.org/2024/09/25/nx-s1-5123633/23andme-is-in-trouble-what-happens-to-all-the-dna-data [https://perma.cc/YCZ4-9VDD].

235. Kwon, *supra* note 232, at 14.

236. Jonathan Stempel, *23andMe Settles Data Breach Lawsuit for $30 Million*, REUTERS (Sept. 13, 2024), https://www.reuters.com/technology/cybersecurity/23andme-settles-data-breach-lawsuit-30-million-2024-09-13/ [https://perma.cc/RQ5R-FYX9 (staff-uploaded)].

consumer neurotechnologies, neural data from consumers will soon be personally identifiable. Will the rapidly expanding consumer neurotechnology market, as it amasses large amounts of neural data, experience the same growing pains and risks that the consumer genetic testing space has seen?

The fate of the genetic data of millions of users is currently uncertain.[237] Companies like 23andMe have widely shared genetic data with pharmaceutical companies, governmental agencies, and law enforcement officers.[238] Absent strong, pro-consumer policy provisions in the terms of use agreements employed by neurotechnology companies—and without a national neural privacy law—there is little to stop companies from disclosing neural data to a wide range of actors. As one Canadian study concluded, the privacy risks inherent in using neurotechnologies are compounded by "the behavior of consumers who accept user agreements with little regard to their terms, thereby giving access to their brain data for mining, analytics, and purchase by third parties."[239]

There is a demonstrable need for greater privacy protection of neural data. Preferably, such data protection will avoid the patchwork quilt of state data privacy laws (which vary widely in what is protected) and the difficulties in passing a federal neural privacy law. Much like GINA's approach to genetic privacy, such a law has the chance to be preemptive in nature due to the fact that neurotechnology is, comparatively, in its infancy. However, the need for guidance and regulation at the federal level is no less acute simply because neural technology has not had its "ChatGPT moment"—a moment that revolutionized and democratized generative AI seemingly overnight.[240]

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237. Katie Kindelan, *What 23andMe Business Troubles Could Mean for Millions of Users' Genetic Data*, ABC NEWS (Nov. 14, 2024, 8:06 AM), https://abcnews.go.com/GMA/Wellness/23andme-dna-data-security/story?id=115818849 [https://perma.cc/7A5A-UHD5].

238. Kwon, *supra* note 232, at 15.

239. Nicole Minielly, Viorica Hrincu & Judy Illes, *Privacy Challenges to the Democratization of Brain Data*, ISCIENCE, 23:6 (June 26, 2020), at 1.

240. Amber Jackson, *ChatGPT Turns One: How AI Chatbot Has Changed the Tech World*, TECH. MAG. (Nov. 30, 2023), https://technologymagazine.com/articles/

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A federal neural privacy law may very well encounter some of the obstacles that GINA has encountered in its seventeen-year history. There may be conflicting judicial interpretations of the statute's definitions and applications, as GINA has been treated. In addition, depending on its scope, critics may feel such a proposed neural privacy law goes too far and is guilty of overreach—or, as with GINA, that it does not go far enough. Nevertheless, the mere prospect that such a proposed law might be imperfect is no justification for the complete absence of any regulation at the national level.

Many aspects would need to be seriously considered for such a law, including its enforcement and penalty provisions, as well as the entities to which it would apply. But perhaps the most challenging question may very well be the threshold issue of defining the terms "neural data" and "neurotechnology." At the risk of offending Minnesota legislators and various academics, this Article proposes that a federal neural privacy law should eschew unnecessarily vague terms and amorphous concepts like "cognitive liberty."

Instead, this Article proposes a definition of "neural data" that is sufficiently descriptive, yet which lends itself to broad application, like Colorado's statutory definition: "information that concerns the activity of an individual's central nervous system of peripheral nervous systems, including the brain and spinal cord, and that can be processed by or with the assistance of a device."[241] This broader definition is better suited than the definition found in its California counterpart, which refers to "information that is generated by measuring the activity of a consumer's central or peripheral nervous system, and that is not inferred from nonneural information."[242] The California definition is too limiting and fails to account for data that includes inferences or interpretations of, for example, EEG activity. This interpretive data should be just as worthy of privacy protection as the recording of brain wave data itself.

"Neurotechnology" presents a more difficult definitional choice. Because of the rapid pace of technological innovation, attempts to

chatgpt-turns-one-how-ai-chatbot-has-changed-the-tech-world [https://perma.cc/T47L-Z8TS (staff-uploaded)].

241. COLO. REV. STAT. § 6-1-1303 (effective July 1, 2025).

242. CAL. CIV. CODE § 1798.140(ae)(1)(G)(ii).

impose a definition of neurotechnology run the risk of being overly restrictive or doomed to incipient obsolescence.[243] For this reason, it would be best to adopt a definition susceptible to broad interpretation by courts and regulators.

A complete draft of a proposed statute is beyond the scope of this Article. However, given the need for a neural privacy law, the time to consider what its contents might entail is now. Otherwise, other states will follow Colorado's and California's examples, leaving the U.S. with a crazy quilt of neural privacy laws—much like its current legal landscape of general data privacy.

VI. Conclusion

The brain is unlike any other organ because it generates all of one's mental and cognitive activities. It logically follows that the information it produces is unlike any other data, since it reflects mental processing.

Neural data—the information directly showing the activity of a person's central or peripheral nervous system—can reveal incredibly sensitive information about the person from whom it was collected, including identifiable information about her health (both physical and mental). This data's sensitivity will continue to increase as private-sector investment helps improve neurotechnological capabilities. Brain scans resolutions will increase, neural datasets will grow exponentially (think of the roughly fourteen million consumers who swabbed their cheeks and sent their DNA to 23andMe), and AI will enhance interpretations of this data.[244] Wearable devices continue to proliferate, and every week seemingly brings word of astonishing achievements in the realm of BCIs like Neuralink.

Neurotechnology is not fringe technology: Major companies have entered this space, such as Meta with its Orion glasses. As this

243. Jonas J. Monast, *Emerging Technology Governance in the Shadow of the Major Questions Doctrine*, 24 N.C. J.L. & TECH. 1, 4 (2023) (noting that a "common challenge[ ] with emerging technology governance" is designing a regulatory system "flexible enough to keep pace with changing technologies").

244. *See, e.g.*, *How Can AI Advance Understanding of the Brain?*, CALTECH: SCI. EXCH., https://scienceexchange.caltech.edu/topics/neuroscience/ai-and-neuroscience [https://perma.cc/L57X-MZNF] (last visited Apr. 3, 2025).

burgeoning area of technology continues to flourish, understandable questions arise concerning how to protect the privacy of the neural data. Yet, currently, companies have virtually unlimited access to this data. Something must be done.

There are gaps between the privacy practices of consumer neurotechnology companies and existing consumer privacy expectations and laws. U.S. law lags behind international counterparts in protecting neural privacy rights. Under U.S. law, the only general categories of data protection for American consumers are for health data and financial data. In light of its sensitivity, medical-grade neural data gathered outside of a healthcare environment should also be protected by U.S. law.

Though some states have passed neural privacy laws, national-level action is needed to avoid the disparities that currently plague America's patchwork quilt of *twenty* state data privacy laws. This Article proposes a federal neural privacy law, patterned after GINA (the federal law for genetic information rights).

Brainwaves have been compared to the work of an orchestra, "with billions of neurons cooperating to produce the symphony we call thought."[245] If that is the case, then neurotechnology serves as a kind of sheet music, measuring electrical activity made when neurons fire and revealing hidden truths: Is one anxious? Depressed? Problem-solving?

Brainwaves tell all, and neurotechnology collects and analyzes these "tells." It is time for the law to get on the same wavelength as technology.

245. Eric J. Lerner, *The Music of the Brain*, 21STC (Fall 1999), https://www.columbia.edu/cu/21stC/issue-4.2/lerner.html [https://perma.cc/XB3W-Y74Z].