**II. Physiological irregularities, memory** (**Brain) manipulation from remote:**

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1. **Brain waves**: These are oscillating electrical voltages in the brain, measuring just a few millionths of a volt. The main frequencies of human ElectroEncephaloGram (EEG) waves are listed above with their characteristics. Researchers in some of these studies found a relationship between certain aspects of EEG waves, event-related potentials (ERPs), and scores on a standard psychometric test of intelligence. Researchers have suggested that the use of averaged evoked potentials and the speed of processing are associated with individual differences in intelligence. (CitnBrain\_1Brain Waves\_an overview \_ScienceDirectTopics)

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| | **Frequency band** | **Frequency** | **Brain states** | | --- | --- | --- | | Gamma (γ) | &gt;35 Hz | Concentration | | Beta (β) | 12–35 Hz | Anxiety dominant, active, external attention, relaxed | | Alpha (α) | 8–12 Hz | Very relaxed, passive attention | | Theta (θ) | 4–8 Hz | Deeply relaxed, inward focused | | Delta (δ) | 0.5–4 Hz | Sleep |   Characteristics of brain waves | https://ars.els-cdn.com/content/image/3-s2.0-B9780128044902000026-f02-01-9780128044902.jpg |

Brain wave signals are acquired using electroencephalography (EEG) sensors, processed and decoded to identify the category to which the signal belongs. Once the signal category is determined, it can be used to control external devices. However, the success of such a system essentially relies on significant feature extraction and classification algorithms. One of the commonly used feature extraction technique for BCI systems is common spatial pattern (CSP). The SPECTRA predictor effectively finds features that are more separable and shows improvement in brain wave signal recognition that can be instrumental in developing improved real-time BCI systems that are computationally efficient.  **(**CitnBrain32\_SpectraToolBrainWaveRecognition)

1. **Neuroscience and Brain Manipulation:** Advances in neuroscience modeling of receptor sites in the human brain, coupled with new knowledge of the human genetic code emerging from both the Human Genome Project and the Human Diversity Project, have opened a path for the malign use of biological sciences for targeted human control. With such misuse of bioweapons, there is a risk of behavior modification, race-specific crowd control weapons, and area denial technologies. Most of these crowd control weapons have also been configured into vehicle or aircraft-launched formats, acting as a mobile riot dispersal unit.

The human brain has thousands of so-called receptor sites, including opioid receptors. The body manufactures molecules called enkephalins and endorphins, which bind with these receptors to alleviate pain, induce sleep, slow down breathing, or affect various emotions. The Human Genome Project has mapped these receptor sites, revealing those that evoke sleep, obedience, submission, sexual display, etc. Of the few identified, some can cause temporary blindness, make you think you are smelling something that is not there, or induce submissiveness or extreme anxiety. A few synthetic chemicals bind very specifically to opioid receptors and induce sleep. From these, chemical crowd control weapons have been developed, many of which are based on analgesics that induce sleep, called calmatives. Certain derivatives of fentanyl, e.g., carfentanyl, are extremely toxic, more so than nerve agents like VX, with ten micrograms per kilogram body weight being able to induce paralysis. Some butyrophenone tranquillisers and anticholinergic glycollates produce mental confusion, elevated blood pressure, vomiting, prostration, and coma, and their effects can last for just a short duration or hours or even days. (CitnBrain\_2CrowdContPart2\_2000\_CrowdControl\_STOA\_ET(2000))

1. **Pulsed Electromagnetic Fields and cognitive processes**: A pilot study was conducted to investigate the effects of pulsed electromagnetic fields on cognitive processes using a psycho-physiological test paradigm. The study found that exposure to these fields impaired cognitive performance and recommended restricted use of cellular phones, especially among high-risk groups such as the elderly, children, and individuals with health issues. (CitnBrain\_3PulsedEMFCogn\_of pulsed electromagnetic fields on cognitive processes)
2. **Neuromodulation:** i) Neuromodulation plays an invaluable role in understanding neural circuits and advancing the clinical treatment of neurological diseases. Optoacoustic neuromodulation is an emerging modality that leverages the benefits of ultrasound's deep penetration and the precision of photons. It utilizes laser, ultrasound, and infrared radiation to stimulate neural activity using biocompatible materials, graphene nanoribbons film, and nanotransducer-based devices with unique absorption in the near-infrared (NIR) wavelength. These applications are quantified in in vivo studies.(CitnBrain\_4NeurStimByOptoacoust\_NPh-009-032207)

ii) Infrared neural stimulation (INS) allows the modulation of nerve cell activity through thermally induced capacitive currents and thermal sensitivity ion channels. The computational model provides new insights into elucidating mechanisms and informing parameter selection for INS. Researchers applied a temperature-dependent model of ion channels and membrane capacitance based on the photothermal effect to quantify the effect of INS on the direct response of individual neurons and neuronal networks. The neurons were connected through excitatory and inhibitory synapses, constituting a complex neuronal network model. The results showed that a slight increase in temperature promoted neuronal spikes and enhanced network activity, whereas ultra-temperature inhibited neuronal activity. This biophysically-based simulation illustrated the optical dose-dependent biphasic cell response, with capacitive current as the core change condition. (CitnBrain\_5computmodelinfraredNeuralStimul\_\_fncom-16-933818)

1. **Deep Brain Stimulation using implant with wireless power transfer:** A study reports a fully implantable Deep Brain Stimulation (DBS) System with wireless power transmission for long-term use in Rodent Models of Parkinson's Disease. (CitnBrain\_6Implant\_remote\_\_jkns-57-152)
2. **Neurowarfare and Brain Manipulation:** Neuroweapons that target the brain to influence cognition and behavior are leading to a new domain of warfare—neurowarfare. The pulsing sounds and experiencing neurophysiologic and cognitive symptoms manifest in ways similar to traumatic brain injury (TBI) but without inciting trauma. (CitnBrain\_7DEWDefeLitRevw\_ADA583714)
3. **Remote Brain Manipulation:** The sound waves demonstrate the ability to modulate neural activity in specific brain circuits remotely and systematically. In a study, low-intensity ultrasound pulses were delivered noninvasively into specific brain regions of macaque monkeys, influencing their decisions regarding which target to choose. The effects were substantial, and the presence and polarity of the effect were controlled by the specific target region, showcasing the ability to influence choice behavior noninvasively. (CitnBrain\_8RegionSpecChoiceBeha\_Remote\_aaz4193)
4. **Brain Implants and Neural Interfaces:** i) Research has mapped some cases of human structural and functional connectivity patterns (i.e., connectome) at the macroscopic level, identifying that brain networks exhibit a prominent "small-world" networking organization. These networks undergo continuous changes during normal development and aging and show dramatic alterations in neurological and psychiatric disorders. The metrics related to this small-world network are supposed to be associated with individual cognitive performance. (CitnBrain\_9SmallWorldBrainNetw\_Liao\_NBR2017).

ii) In another study focused on seizure simulations, specific brain signals (neuronal network dynamics) are simulated using full Hodgkin-Huxley (HH) simulations on a Small-World Network. This approach can generate synthetic electroencephalogram (EEG) signals with intervals corresponding to seizures. By adjusting the HH parameters, researchers can model seizures resulting from various causes, including traumatic brain injury (TBI), congenital channelopathies, and idiopathic etiologies, as well as the effects of anticonvulsant drugs. The results of this work may be used to identify parameters from actual patient EEG or electrocorticographic (ECoG) data associated with ictogenesis, as well as generate simulated data for training machine-learning seizure prediction algorithms.. (CitnBrain\_10SimuEEGSmallWorld\_Ictal\_Louis).

iii) Since brain function or activity can be simulated, we believe that criminal manipulation is being conducted on individuals using brain-computer interface (BCI) and signal broadcasting without being visually detected by the victims. Real-time BCI systems use Common Spatial Pattern (CSP) to recognize brainwave signals from electroencephalography (EEG) sensors. (CitnBrain\_11BrainWaveSIgDuringEEG\_12859\_2021)

iv) A study demonstrated the wireless acquisition of concurrent electrophysiological signals during functional magnetic resonance imaging (fMRI). (CitnBrain\_12ReadElectroPhys\_biorxiv\_259762).

v) In a study conducted by IISc, Bangalore, on "multifunctional transparent electrode array for in-vivo delineation of tumor/stroke from normal," the excitable neural tissues can be electrically stimulated, producing functional responses to identify eloquent cortexes. Alternatively, action potentials can be recorded to determine the functional regions of the brain, exploring different electrical behaviors of brain tissue to delineate tumor/stroke margins. Modules for the study utilize three modalities: (a) Direct Electric Stimulation (DES), (b) Electrical Impedance Spectroscopy (EIS), and (c) Electrocorticography (ECoG) processes with MATLAB. (CitnBrain\_13IISc\_ECoGDevice\_MultifnTumour\_BrainBEES LAB).

vi) The ability to influence choice behavior noninvasively enables systematic brain circuit hacking without the knowledge of the victim. Implantable wireless bidirectional communication microstimulators can be used for neuromuscular stimulation. (CitnBrain\_14ImplBidirStimul\_\_AnImplantableWirelessBidirectionalCommunicationMicrostimulatorforNeuromuscularStimulation).

vii) Implantable biomedical systems that support most functionalities of implantable medical devices use either wired or wireless radiofrequency telemetry to communicate with circuitry outside the body. Communication with implanted devices is usually accomplished with a wired connection or wireless radiofrequency (RF) transmission. Wireless RF telemetry has been employed in several implantable medical devices to avoid the complications of wired implants. RF telemetry also requires a relatively large antenna.. (CitnBrain\_15Wireless Radio Frequency Transmission for Bladder Pressure).

viii) Recording and neuromodulating neural activity using a miniaturized, biocompatible, battery-free, wirelessly communicable, closed-loop advanced neural interface device is reported in research for controlling overactive bladder function in mice. The wireless interface devices can range from 1 mm to 10 mm in size. Power is transferred via electromagnetic radiation or acoustic waves. Wireless implantable medical devices are now widely used for therapeutic stimulation or neuroscience research in freely moving subjects. Some approved devices, such as brain-contacting stimulators or implanted stimulators that control various organs and their functions, can be found in medical literature review publications. (CitnBrain\_16EmerImplantCell). A list of emerging modalities of implantable technologies for neuromodulation, including their class and manufacturers, can be found in the presentation. (CitnBrain\_17NeuroImplClass\_Neuromodulation-overview\_ScienceDirect Topics)

1. **(Ultra/ Infra) sonic Neurostimulation:** i)A study investigated radiation force as the physical mechanism by which ultrasound is converted into an effective energy form to cause neurostimulation in the retina. The study found that ultrasound acts through radiation force, leading to a mechanical displacement of tissue. Applying a quantitative model to understand how ultrasound generates radiation force and leads to neural activity will be important in optimizing ultrasonic neurostimulation across a wide range of applications. (CitnBrain\_18RadiEyeUltra\_JNEUROSCI2019)

ii) Infrasound weapons capable of causing involuntary defecation fall under the SlrUS criteria for banning weapons that target the human anatomy. (CitnBrain\_2CrowdContPart2\_2000\_CrowdControl\_STOA\_ET(2000)

1. **Brain-Computer Interfaces:** i) Steady-state visual evoked potential (SSVEP) is a prevalent paradigm of brain-computer interface (BCI). Deep neural networks (DNNs) have been employed for SSVEP target recognition, and brain signals are simulated by creating synthetic EEG data via neural-based generative models for improved SSVEP classification. (CitnBrain\_19Simulating Brain Signals\_Synthetic EEG\_Generative Models).

ii) Traditional hearing aid devices do not correct hearing losses but amplify sound. A report on bone-conduction devices (BCDs) reveals that they enable people with impaired hearing to hear sounds without the usage of their eardrums. Bone conduction involves the transmission of sound vibrations directly to the inner ear (cochlea). Various types of bone conduction devices, based on different principles, can be used by patients. (CitnBrain\_20Bone Conduction for MMachine Interface)

iii) The placement of subdermal implants of Radio Frequency Identification Device (RFID) microchips in human beings contains a unique ID number that can be linked to information in an external database. This information may include personal identification, medical history, medications, allergies, and contact information. (CitnBrain\_21ChipToId)

iv) Scientists developed a novel fully implantable wireless 128-ch recording human ECoG BMI device capable of recording and transmitting electrocorticography (ECoG) signals with both millisecond precision and recording stability, found that this wireless device can be a translational tool for other fundamental neuroscientific

studies in free-moving models. (CitnBrain32\_WirlessBMIImplant).

v) Electroencephalograph is the summation of neural activities in the brain and provides a gross indicator of brain functions. Invasive EEG monitoring with intracranial electrodes is indicated using either subdural electrodes (strips and grids) or depth electrodes (stereo-EEG). EEG can potentially facilitate functional brain mapping with temporal resolution in the millisecond range. (CitnBrain34\_AdvancingEegInvasive).

vi) Human sensory and motor systems naturally facilitate the exchange of information between individuals, forming the basis for human civilization. The recent development of brain-computer interfaces (BCI) has contributed to the creation of brain-to-brain communication systems, while precise brain stimulation techniques enable non-invasive computer-brain interfaces (CBI). Combining these technologies, BCI and CBI, allows the realization of non-invasive, computer-mediated brain-to-brain (B2B) communication, a concept known as hyperinteraction. In this study, researchers demonstrate the conscious transmission of information between human brains through the intact scalp, without intervention from motor or peripheral sensory systems. Pseudo-random binary streams encoding words were successfully transmitted between emitter and receiver subjects separated by great distances, marking the achievement of the first human brain-to-brain interface. Through a series of experiments, internet-mediated B2B communication was established. This involved combining a BCI, based on voluntary motor imagery-controlled electroencephalographic (EEG) changes, with a CBI inducing the conscious perception of phosphenes (light flashes) through neuronavigated, robotized transcranial magnetic stimulation (TMS). Special care was taken to block sensory (tactile, visual, or auditory) cues. The research results provide a critical proof-of-principle demonstration for the development of conscious B2B communication technologies. As these technologies evolve, they are expected to open new research avenues in cognitive, social, and clinical neuroscience, as well as the scientific study of consciousness. Researchers envision that hyperinteraction technologies will eventually have a profound impact on the social structure of our civilization, raising important ethical issues. (CitnBrain\_22brainToBrain\_Commn)

vii) Studies on the effects of RFR on the nervous system involve many aspects: morphology, electrophysiology, neurochemistry, neuropsychopharmacology, and psychology. Different parameters of RFR, such as power density, intensity, frequency, waveform, dose-range etc. affect the response outcome. An obvious effect of RFR on an organism is an increase in temperature in the tissue, which

will trigger physiological and behavioral thermal regulatory responses. These responses involve neural activities both in the central and peripheral nervous systems. Activation of thermoregulatory mechanisms can lead to neurochemical, physiological, and behavioral changes. Changes in neurochemical functions lead to changes in behavior in an animal. Whether RFR can directly affect the activity of excitable tissues, the thermal effect of RFR on the peripheral nervous system can lead to changes in central nervous system functions and behavior in the exposed animal. Research has been carried out to investigate the effects of RFR exposure on spontaneous and learned behaviors. Motor activity is the most often studied spontaneous behavior. Alteration in motor activity of an animal is generally considered as an indication of behavioral arousal. For learned behavior, conditioned responses were mostly studied in bioelectromagnetics research.

The behavior of an animal is constantly being modified by conditioning processes, which connect behavioral responses with events (stimuli) in the environment. Two types of conditioning processes have been identified and they are known as classical and operant conditioning. In classical conditioning, a 'neutral' stimulus that does not naturally elicit a certain response is repeatedly being presented in sequence with a stimulus that does elicit that response. After repeated pairing, presentation of the neutral stimulus (now the conditioned stimulus) will elicit the response (now the conditioned response). Interestingly, the behavioral control probability of the conditioned stimulus is shared by similar stimuli, i.e.,

presentation of a stimulus similar to the conditioned stimulus can also elicit the conditioned response. The strength and probability of occurrence of the conditioned response depends on the degree of similarity between the two stimuli. This is known as "stimulus generalization."

A paradigm of classical conditioning used in bioelectromagnetics research is the

"conditioned suppression" procedure. Generally, in this conditioning process, an aversive stimulus (such as electric shock, loud noise) follows a warning signal. After repeated pairing, the presentation of the warning signal alone can stop or decrease the on-going behavior of the animal. The animal usually "freezes" for several minutes and shows emotional responses like defecation and urination. Again, stimulus generalization to the warning signal can occur.

Operant (or instrumental) conditioning involves a change in the frequency or probability of a behavior by its consequences. Consequences which increase the rate of the behavior are known as "reinforcers". Presentation of a "positive reinforcer", e.g., availability of food to a hungry animal, increases the behavior leading to it. On the other hand, removal of a "negative reinforcer", e.g., an electric shock, also leads to an increase of the behavior preceding it. Presentation of an aversive stimulus will decrease the probability of the behavior leading to it. Use of reinforcement-schedules can generate orderly and reproducible behavioral

patterns in animals, and thus, allows a systematic study of the effect of an independent variable, such as RFR. (CitnBrain35\_BehaviorConditioning)

1. **Blue Brain and Nanobots:** The human brain, a reservoir of intelligence, may see its intelligence virtually persist after an individual's death with the aid of new technology. "BLUE BRAIN" is a groundbreaking concept where the recorded structure and signals of the human brain are uploaded to a supercomputer, creating a simulation of intelligence processes. The uploaded brain structure in the computer functions as a Virtual Brain. Nanobots, incredibly small, navigate through the circulatory system and serve as an interface between the human brain and the supercomputer. These nanobots record the structural neurons transmitting signals and the brain's responses to stimuli from the body, essentially acting as a bridge between the brain and the body. Scientists can upload all the recorded brain data into a supercomputer equipped with extensive storage capacity and processing power, known as Blue Brain Technology or brain chip technology. This information is stored in secondary memory, ensuring no loss of data, and the gathered data is preserved permanently. The result is the creation of a virtual brain in the supercomputer, capable of performing functions analogous to the human brain. (CitnBrain\_23BlueBrain). Blue Brain is recognized as the world's first virtual brain, designed to function similarly to the human brain. Current research endeavors focus on constructing an artificial brain capable of thinking, responding, making decisions, and storing information in memory. Scientists are particularly interested in the prospect of upgrading the human brain into a machine, marking a significant step toward artificial intelligence. Blue Brain serves as a conduit to artificial intelligence, encompassing sensory inputs, integration, and motor outputs. The sensory cells in our body, known as neurons, transmit messages directly to the brain when we touch a warm surface or see something with our eyes. This process of acquiring information from the surrounding environment is termed sensory input.

Integration involves the collaboration of numerous neurons in the brain to comprehend the environment. Motor output occurs when the brain sends messages through neurons to effector cells, muscles, or gland cells, enabling them to perform actions. Brain simulation aims to develop a working computer model of either the entire brain or a specific portion. (CitnBrain\_24BlueBrainBlog)

1. **Emerging Neuroweapons:** Wurzman and Giordano characterize neuroweaponry as the alteration of nervous system functions to influence cognitive, emotional, and/or motor activity and capability. Neuroweapons encompass chemical or biological weapons designed to disrupt breathing or the nervous system, such as nerve gas. They also include pharmaceuticals for sleep-deprived troops, like stimulants, and agents to induce sleep in enemy combatants, such as sedatives, along with sleep deprivation techniques to enhance interrogation outcomes.

From neurotropic drugs capable of manipulating moods to intelligence tools that can forecast crowd behavior, there is a pressing need for new arms control efforts. Recent developments in weaponry span from missiles with pinpoint accuracy that can reach the other side of the world to software code and malware capable of instantly discombobulating factory equipment in distant locations. Micro air vehicles, the size of insects, conduct reconnaissance missions in otherwise inaccessible urban areas and caves. Robotic weapons that can sense, think, and act autonomously are now a reality, alongside considerations of the explosive yield of a nuclear detonation. The breakthroughs in neuroscience present innovative possibilities for weapons within the national defense and security apparatuses of states. Beyond ongoing concerns about existing neuroweapons, there is a call for serious ethical reflection, policy debate, and international cooperation in the realm of emerging neuroweapons. (CitnBrain\_25Future defense\_Neuroweapons)

1. **Privacy and Security Concerns:** The Pentagon has issued a warning to military members about the potential 'personal and operational risks' posed by DNA kits. These direct-to-consumer genetic tests, largely unregulated, carry the possibility of exposing personal and genetic information. The concern is that this exposure could lead to unintended security consequences and increased risk to both the joint force and mission. Despite the valuable insights into ancestry, medical risks, and the identification of unknown family members provided by DNA results, the military advises caution due to these potential risks. (CitnBrain\_26PentagonDefense\_secissue)
2. **Havana Syndrome:** A consensus study report by the National Academies of Sciences, Engineering, and Medicine, assessing the illnesses referred to as Havana Syndrome among U.S. Government employees and their families at Overseas Embassies (2020), found that the unusual presentation of acute, directional, or location-specific early-phase signs, symptoms, and observations reported by Department of State employees is consistent with the effects of directed, pulsed radio frequency (RF) energy. Many of the chronic, nonspecific symptoms are also in line with known RF effects, including dizziness, headache, fatigue, nausea, anxiety, cognitive deficits, and memory loss. (CitnBrain\_27HavanaAssesEmpl)
3. **Ethical Issues in Neurotechnology, Brain Recording, and Mind-Reading:** Brain reading technologies are rapidly advancing across various neuroscience fields, capable of recording, processing, and decoding neural signals. Often referred to as 'mind reading technology,' these advancements raise ethical concerns, especially in popular media. Worries about mind-reading technologies may involve the erosion of free deliberation and self-conception when one's thoughts become accessible. Themes such as privacy, cognitive liberty, and self-conception and expression emerge as vital ethical considerations. This article explores the question of whether brain reading technologies truly qualify as mind reading technologies and, if so, advocates for the development of ethical frameworks to address them. (CitnBrain\_28BrainReadEthics)
4. **UN Resolution:** To protect the sanctity of human existence the United Nations has issued the resolution #51/3 on “Neurotechnology and human rights” in Oct 2022. (CitnBrain\_29UNResolution\_Neurotechnology).
5. **Concerns**: In cognitive warfare, two types of weapons are employed to manipulate the cognitive capabilities (neuro-system) of targets. First are microwave or energy-based weapons, often referred to as NeuroStrike or neuro-cognitive disruptors, known for their reported effectiveness within a range of 3,000 meters. The second involves the use of IoT, print and electronic media, and other forms of propaganda (Influence Operations) to influence the cognitive domain of the population, decision-makers, or military commanders. These weapons share three distinctive characteristics: they are not visible, their impact is felt later, attribution poses a serious problem, and targets often remain convinced of the arguments planted by the initiators of cognitive warfare, acting as their agents. Neuro-Strike weaponry, in particular, has the capability to instill intense fear and/or other forms of cognitive incoherence, leading to inaction. Encouraging advanced research to develop countermeasures against energy-based weapons is imperative. AI technologies should be employed to alert the population, diplomats, and armed forces about such attacks, providing automated cover to contain the impact. Although this may take time, initiating defensive capabilities against energy-based weapons (neurocognitive disruptors) should be a priority. (CitnBrain30\_NeuroTOIPradan).

An Event-Related Potential (ERP) is a measurable brain response directly resulting from a specific sensory, cognitive, or motor event, with its measurement facilitated through Electroencephalography (EEG). Scholars propose incorporating ERPs into forensic investigations, akin to established techniques like fingerprints and DNA, as a means of solving crimes. The idea of utilizing Brain-Computer Interfaces (BCIs) as forensic tools involves administering a guilty knowledge test (GKT) to a suspect, containing information pertinent to the crime, while specialists record EEG signals. Signal analysis is then applied to the recorded electrical signal to ascertain the significance of the crime-related information to the suspect. If proven significant, the suspect is classified as guilty. A variant of ERP is Brain Electrical Oscillation Signature Profiling (BEOS), developed in 2003 in India. BEOS captures the brain oscillation signatures of individuals participating in a crime. Presently, investigators employ BEOS as a forensic tool, and attorneys utilize it as corroborative evidence in criminal trials. However, the adoption of such technology raises significant questions pertaining to criminal procedure, evidence, and the rights of criminal suspects.

The term "brain hacking" signifies the emerging threat of malicious actors gaining access to BCIs and other neural devices, mirroring the way computers are susceptible to hacking. The access to the neural processes underlying conscious thought introduces a level of self that cannot be consciously filtered. This poses a risk to individual privacy and dignity, potentially suppressing free will and breaching the fundamental sanctuary of human freedom—the human mind. The merging of neurological and digital experiences may diminish personal identity, agency, and moral responsibility, altering the nature of humanity and human societies. This calls for a reform not only in laws but also in our perspective on NeuroData and the protections it should receive. Attackers targeting BCIs can establish authentication by verifying individuals through their EEG signals. In such scenarios, hackers may exploit the authentication system using synthetic EEG signals or smartphone-based applications. Misusing neural devices for malicious purposes not only jeopardizes users' physical security but also influences their behavior, altering their sense of identity and personhood. This violation goes against moral values of autonomy, free will, and self-determination. Consequently, there is a call for suggestions on appropriate legal safeguards to be established. While BCI applications are developed to enhance the quality of life by providing access to a user's brain signals and the features extracted from them, they raise serious concerns about user privacy. Article 12 of the Universal Declaration of Human Rights (UDHR) protects the right to privacy, emphasizing that "no one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, nor to attacks upon his honor and reputation." Similarly, Article 8 of the 1950 European Convention on Human Rights (ECHR) asserts that "everyone has the right to respect for his private and family life, his home and correspondence."

Privacy encompasses two dimensions: the interest in being left alone and the right to conceal discreditable facts about oneself. In Europe, the recognition of the right to privacy has gained prominence through the General Data Protection Regulation (GDPR). This regulation is designed to empower individuals with control over their data, countering the common practice of multinational corporations, especially in media and communication, collecting and processing users' data for monetary gain.

The pivotal question emerges: Does the existing privacy protection regime adequately cover mental data? The adoption of the Universal Declaration of Human Rights (UDHR) in 1948 did not anticipate the future challenges posed by technologies like BCIs and artificial intelligence. As a result, there are no provisions in the UDHR addressing the new threats arising from technological advances. Rights that were once taken for granted are now susceptible to potential violations.

One of the most worrisome dystopian scenarios related to Brain-Computer Interfaces (BCIs) involves their utilization by the state, military, and powerful entities like employers. In a Nature Review Neuroscience article, the authors suggest the potential to decode mental states from brain activity, acknowledging uncertainties about accuracy and efficiency due to the inferential nature of the decoding process. The exponential progress of science, particularly with artificial intelligence algorithms, has enhanced the decoding of mental states from brain activity. However, concerns arise about potential biases in forensics when this technology is applied to criminal justice. Facebook is actively developing wearable EEG-based BCIs capable of reading and interpreting users' thoughts, emotions, and intentions. This development aims to provide hands-free communication without verbalizing thoughts on its platform. The implications are profound, as this technology could enable the inference of a user's memory, emotional reactions, and conscious and unconscious interests. Implementing this technology means Facebook would gain access to read the neural and mental activity of millions of users, detecting brain signals whenever a user's brain responds to noteworthy stimuli.

We succinctly identify four new human rights at the intersection of neuroscience and human rights, anticipating their growing relevance in the coming years:

1. The right to cognitive liberty.
2. The right to mental privacy.
3. The right to mental integrity.
4. The right to psychological continuity.

These rights encapsulate the evolving challenges and ethical considerations arising from advancements in neuroscience and underscore the importance of protecting individuals' cognitive and mental well-being. (CitnBrain31\_BCINeurolaw).

Brain mapping and directed energy technologies have empowered governments to develop devices and applications at relatively low costs, capable of spanning the globe to target:

i. Individual Thoughts: Negatively influencing an individual's thoughts in real time.

ii. Physiological Manipulation: Manipulating an individual's innate physiological processes against their health and wellness without leaving evidence, as in traditional methods.

iii. Motion or Flexibility Manipulation: Manipulating an individual's physical motion and flexibility at computer speed to cause harm.

iv. Conscious and Subconscious Manipulation: Overriding an individual's innate sanctity of self by manipulating both conscious and subconscious aspects, including memories. This manipulation can involve inflicting false memories, deleting innate memories like puppets, and inducing social, psychological, and integrity issues.

v. Digitized Brain Connectivity: Digitized brains can be interlinked to form hive-minds, supercomputers, and blue brains.

vi. Violation of Human Rights: All of these actions violate fundamental human rights, defying established laws. The technology used should be made known to the public. When employed in the name of surveillance, the accountability of government and/or private agents must be documented to prevent the fueling of totalitarian dictatorships. Citizens need a mechanism for the justice system to address grievances, and public services and departments should not isolate individuals, families, or engage in genocide. Organized crimes beyond the scope of citizens, orchestrated by entities such as politicians or foreign agendas, require transparency, accountability, and the safeguarding of the nation.

Citations:

1. CitnBrain\_1Brain Waves\_an overview \_ScienceDirectTopics: Brain waves, <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/brain-waves>
2. CitnBrain\_2CrowdContPart2\_2000\_CrowdControl\_STOA\_ET(2000): CROWD CONTROL TECHNOLOGIES - European Parliament, Final Study, June 2000, <https://www.europarl.europa.eu/RegData/etudes/etudes/stoa/2000/168394/DG-4-STOA_ET(2000)168394_EN(PAR02).pdf>

3. CitnBrain\_3PulsedEMFCogn\_of pulsed electromagnetic fields on cognitive processes: Effects of pulsed electromagnetic fields on cognitive processes - a pilot study on pulsed field interference with cognitive regeneration, By Maier R, et, al. Acta Neurol Scand. 2004 Jul;110(1):46-52, <https://pubmed.ncbi.nlm.nih.gov/15180806/>

4. CitnBrain\_4NeurStimByOptoacoust\_NPh-009-032207: High-precision neural stimulation through optoacoustic emitters, by Linli Shi, et. al, Neurophotonics. 2022 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8941197/>

5. CitnBrain\_5computmodelinfraredNeuralStimul\_\_fncom-16-933818: Fully Implantable Deep Brain Stimulation System with Wireless Power Transmission for Long-term Use in Rodent Models of Parkinson's Disease, By Man Seung Heo, et al, Journal of Korean Neurosurgical Society 2015; 57(3): 152-158, <https://www.jkns.or.kr/m/journal/view.php?number=587>

6. CitnBrain\_6Implant\_remote\_\_jkns-57-152: Fully Implantable Deep Brain Stimulation System with Wireless Power Transmission for Long-term Use in Rodent Models of Parkinson’s Disease, by Man Seung Heo et. al., J Korean Neurosurg Soc 57 (3) : 152-158, 2015, https://www.researchgate.net/publication/274093110\_

7. CitnBrain\_7DEWDefeLitRevw\_ADA583714: Directed Energy: Medical Effects of Radio Frequency Exposure (Microwave & Millimeter Wave) - A Literature Review, Special rept. Jan 2011-Mar 2012, DEFENSE TECHNICAL INFORMATION CENTER, by Wright, Bruce A et. al. <https://apps.dtic.mil/sti/citations/ADA583714>

8. CitnBrain\_8RegionSpecChoiceBeha\_Remote\_aaz4193: Remote, brain region-specific control of choice behavior with ultrasonic waves by Jan Kubanek, et., al. Sci Adv. 2020 May 20;6(21):eaaz4193 <https://pubmed.ncbi.nlm.nih.gov/32671207/>

9. CitnBrain\_9SmallWorldBrainNetw\_Liao\_NBR2017: Small-world human brain networks: Perspectives and challenges by Xuhong Liao et al, Neurosci Biobehav Rev, . 2017 Jun;77:286-300. <https://helab.bnu.edu.cn/wp-content/uploads/pdf/Liao_NBR2017.pdf>

10. CitnBrain\_10SimuEEGSmallWorld\_Ictal\_Louis: Critical and Ictal Phases in Simulated EEG Signals on a Small-World Network By Louis R Nemzer et. al, Front Comput Neurosci. 2021 Jan 8;14:583350 <https://www.sciencedirect.com/science/article/abs/pii/S0149763416307849>

11. CitnBrain\_11BrainWaveSIgDuringEEG\_12859\_2021: Brain wave signals are acquired using electroencephalography (EEG) sensors, 02, 2021, BMC Bioinofrmatics ,2021 Jun 2;22(Suppl 6):195 https://pubmed.ncbi.nlm.nih.gov/34078274/ - ~~SPECTRA: a tool for enhanced brain wave signal recognition~~

12. CitnBrain\_12ReadElectroPhys\_biorxiv\_259762: Adaptive and Wireless Recordings of Electrophysiological Signals during Concurrent Magnetic Resonance Imaging [ARTICLE]

Ranajay Mandal, et, al., <https://scholar.archive.org/work/vgiinf4lgnckpe4wnydq5zsl64>

13. CitnBrain\_13IISc\_ECoGDevice\_MultifnTumour\_BrainBEES LAB: Minimally invasive Bioresorbable Devices for Anti-epileptic Drug Screening by Recording electrocorticography (ECoG) Signals, <https://labs.dese.iisc.ac.in/beeslab/brain-physiology-neuroscience>

14.CitnBrain\_14ImplBidirStimul\_\_AnImplantableWirelessBidirectionalCommunicationMicrostimulatorforNeuromuscularStimulation: An implantable wireless bidirectional communication microstimulator for neuromuscular stimulation, <https://www.researchgate.net/publication/3451133>

15. CitnBrain\_15Wireless Radio Frequency Transmission for Bladder Pressure: Wireless\_Radio\_Frequency\_Transmission\_for\_Bladder\_Pressure - By Anusha BHandari et, al. Dec 2013, https://www.researchgate.net/publication/269329221

16. CitnBrain\_16EmerImplantCell: Emerging Modalities and Implantable Technologies for Neuromodulation by Min Won, et. al, Cell Volume 181, Issue 1, 2 April 2020, Pages 115-135 <https://www.sciencedirect.com/science/article/pii/S0092867420302312>

17. CitnBrain\_17NeuroImplClass\_Neuromodulation-overview\_ScienceDirect Topics: Neuromodulation is defined as a field of science, medicine, and bioengineering that encompasses implantable and non-implantable technologies, Classification of Neuromodulation Devices, Neuroscience & Biobehavioral Reviews, 2016 <https://www.sciencedirect.com/topics/neuroscience/neuromodulation>

18. CitnBrain\_18RadiEyeUltra\_JNEUROSCI2019: Radiation Force as a Physical Mechanism for Ultrasonic Neurostimulation of the Ex Vivo Retina, By Menz MD, et. al, J Neurosci. 2019 Aug 7;39(32):6251-6264 <https://www.jneurosci.org/content/39/32/6251>

19. CitnBrain\_19Simulating Brain Signals\_Synthetic EEG\_Generative Models: Simulating Brain Signals: Creating Synthetic EEG Data via Neural-Based Generative Models for Improved SSVEP Classification. IJCNN 2019: 1-8 , By Nik Khadijah Nik Aznan et al. (2019) https://ieeexplore.ieee.org/document/8852227

20. CitnBrain\_20Bone Conduction for MMachine Interface: Bone Conduction Auxiliary and Tactics for Man Machine Interface for Hearing Impaired Users, by Yash Gupta et. Al, <https://ieeexplore.ieee.org/document/8441733>

21. CitnBrain\_21ChipToId: The placement of sub dermal implant of Radio Frequency Identification Device (RFID) microchips in human beings can be linked to information contained in an external database containing personal information. <https://ijcrr.com/uploads/1000_pdf.pdf>

22. CitnBrain\_22brainToBrain\_Commn: Conscious Brain-to-Brain Communication in Humans Using Non-Invasive Technologies, by Carles Grau, et, Al. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4138179/>

23. CitnBrain\_23BlueBrain: Blue Brain Technology to Preserve Intelligence, by Akshay B. Patil et. al, International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056, Volume: 03 Issue: 04 | Apr-2016 https://www.irjet.net/archives/V3/i4/IRJET-V3I4275.pdf

24. CitnBrain\_24BlueBrainBlog: Blue Brain – A Subway To Artificial Intelligence, blog by Akshaya MV, https://kahedu.edu.in/blue-brain-a-subway-to-artificial-intelligence/,

25. CitnBrain\_25Future defense\_Neuroweapons: DEFENCE, Neuroweapons: Breakthroughs in Science Change Future Weapons, <https://www.visionofhumanity.org/breakthroughs-in-neuroscience-shaping-the-new-frontier-of-weaponry/>

26. CitnBrain\_26PentagonDefense\_secissue: Pentagon warns military members DNA kits pose ‘personal and operational risks’, BY JENNA MCLAUGHLIN AND ZACH DORFMAN YAHOO NEWS EXCLUSIVE, <https://genomics.ca/pentagon-warns-military-members-dna-kits-pose-personal-and-operational-risks/>

27. CitnBrain\_27HavanaAssesEmpl: An Assessment of Illness in U.S. Government Employees and Their Families at Overseas Embassies (2020), <https://federalnewsnetwork.com/wp-content/uploads/2021/04/Havana-Syndrome-report.pdf>

28. CitnBrain\_28BrainReadEthics: Brain Recording, Mind-Reading, and Neurotechnology: Ethical Issues from Consumer Devices to Brain-Based Speech Decoding, https://www.researchgate.net/publication/341060379

29. CitnBrain\_29UNResolution\_Neurotechnology: UN resolution 51/3 "Neurotechnology and human rights", <https://documents-dds-ny.un.org/doc/UNDOC/GEN/G22/525/01/PDF/G2252501.pdf>

30. CitnBrain30\_NeuroTOIPradan: NeuroSrtike: A new weapon of warfare requiring urgent prophylactic steps, October 10, 2023, SD Pradhan in Chanakya Code, politics, World, TOI <https://timesofindia.indiatimes.com/blogs/ChanakyaCode/neurosrtike-a-new-weapon-of-warfare-requiring-urgent-prophylactic-steps/>

31. CitnBrain31\_BCINeurolaw: Neurolaw: Brain-Computer Interfaces <https://ir.stthomas.edu/cgi/viewcontent.cgi?article=1154&context=ustjlpp>

32. CitnBrain32\_SpectraToolBrainWaveRecognition: SPECTRA: a tool for enhanced brain wave signal recognition, by Shiu Kumar et al. BMC Bioinformatics (2021) 22:195, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8170968/pdf/12859\_2021\_Article\_4091.pdf

33. CitnBrain33\_WirlessBMIImplant: A Fully Implantable Wireless ECoG 128-Channel Recording Device for Human Brain–Machine Interfaces: W-HERBS, by Matsushita et.al;, Front Neurosci. 2018; 12: 511. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6090147/>

34. CitnBrain34\_AdvancingEegInvasive : Advancing Analytics of EEG Signals by Ruchika eet. Al,, Med Discov. 2023; 2(4), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10208433/>

35. CitnBrain35\_BehaviorConditioning : NeurologicalEffectsOfRFElectroMagneticRadiation\_1994\_LaiH.pdf https://link.springer.com/chapter/10.1007/978-1-4615-2542-4\_2