Brain-Control Interfaces in The Coming Age of Trans-humans: Philosophical and Regulatory Mappings

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This article discusses the Philosophical and Regulatory mappings of Brain Control Interfaces in the coming age of Trans-humans. The author combines perspectives from Material Engagement theory, Don Ihde's post-phenomenological perspective and Veerback's cyborg intentionality on human-technology relations and juxtaposes this post-phenomenological hybrid-intentionality on upcoming BCI such as Neuralink. Taking the hybrid-intentionality as point of departure, the author then develops Regulatory approaches and principles in context of the normative harms borne out of such transfiguration while also highlighting these key harms.

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I. INTRODUCTION

It is said that the First person shooter gamer who uses a mouse does not sense the mouse, but the absence or presence of objects in the virtual environment. The mouse which offers the benefit of exploration for the

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gamer is forgotten in itself.[2] With time and practice, optimum tactile feedback is projected through the mouse and the gaming device, making it immersive for the gamer to make kill-streaks in the match. The Body Schema extends to incorporate the mouse, and peripheral sense is somehow acquired in the gaming environment. In short, the brain treats the mouse as if it was an organ of body itself.

The above thought experiment raises provocative questions: Where does our 'being' end and the virtual world begin? How does this mediate the experience of the world for their users? Where do we draw the line between a human being, and the material world? Is the mouse a means to our end or is it part of ourselves? The evolution of human intelligence, especially with the realistic potential of realization of Trans-humans, hinges on these questions that infer the direction of causality between biology and culture.

To explore these concerns, I combine perspectives from the material engagement theory, Don Ihde's post-phenomenological perspective, Heidegger's ontic dimensionality, and Veerback's *cyborg intentionality* on human-technology relations to build a hybrid intentionality framework for Neuralink and other types of BCI. Taking the hybrid intentionality as point of departure, I then attempt to develop regulatory principles to ensure appropriate oversight that address any potential ethical and moral concerns while simultaneously minimizing the risk of normative harms borne out of such transfiguration.

II. BCI – JUXTAPOSITION WITH IHDE'S POST-PHENOMENOLOGICAL FRAMEWORK, MATERIAL ENGAGEMENT THEORY & VEERBACK'S CYBORG INTENTIONALITY

Human beings, since their genesis, have been altering the paths of their evolution by creating and manipulating novel material forms leading to the possibilities of material engagement.[3] The foundational premise of Idhe's Phenomenological Human Technology Relations framework is that we '*become*' through making and using technologies that shape our minds and extend our bodies, i.e. we make tools and tools in turn make us. Contra to the

[2] *See generally* MIHALY CSIKSZENTMIHALYI. FLOW: THE PSYCHOLOGY OF OPTIMAL EXPERIENCE. (Harper & Row 1990); MAURICE MERLEAU-PONTY PHENOMENOLOGY OF PERCEPTION (C. Smith trans., Routledge and Kegan Paul 1962) (1945).

[3] Don Ihde & Lambros Malafouris, *Homo faber Revisited: Postphenomenology and Material Engagement Theory* 32 *Philos Technol.* 195 195–214 (2019). [Hereinafter HomoFaber].

Neo-Darwinian view[4] that we are organisms of 'nature', 'biology' or 'culture', Ihde conceives our human mode of being as a continuum of human-prosthesis inter-relations.[5] This conception does not in any way imply our dissonance with other animals or organisms.[6] At the essence of this conception lies the simple fact: human beings besides adapting to the environment are also changing them.[7]

The age-old dialectic between man and his tools have been recognised and interpreted across various disciplines apart from the contrarian notion that humans and things are co-constituted. Technology, in its sociological form, as derived from the thought of Marx Weber, was said to play in the role of disenchantment of nature and the desacralizing of the earth.[8] It was said to be the prime cause of the decline of *Kultur*.[9] It raises further existential points of inquiry. In Husserl, a certain emphasis is placed on embodiment; the role of "Praxical" and perceptual experience.[10] What does Idhe means when he says that technologies make us as much as we make technology?

Idhe's post phenomenological framework places emphasis on the phenomenon of 'technological embodiment'[11] and on the types of skill, Praxis and self-consciousness.[12] We have evolved by manipulating our environment to create new materials.[13] (from marbles, stones & ceramic to wood, metals, silicon, plastic). Intelligence in its originality, stripped of all the pride, consists of the faculty of manufacturing artificial objects, specifically the

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[4] *See generally* CHARLES DARWIN. THE ORIGIN OF SPECIES BY MEANS OF NATURAL SELECTION, OR THE PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE (J Murray ed., 6th ed. 1872).
[5] *See* Don Ihde, *Postphenomenological re-embodiment.* 17 Foundations of Science, 373 373–377 (2012).
[6] *Id.,* at 197.
[7] Homfaber *at* 196.
[8] DON IDHE'S, TECHNICS & PRAXIS: A PHILOSOPHY OF TECHNOLOGY (Springer 1979th ed. 1978). [Hereinafter Praxis].
[9] *Ibid.*
[10] *See* JEFFREY YOSHIMI, HUSSERLIAN PHENOMENOLOGY, A UNIFYING INTERPRETATION. (Springer 1st ed. 2016).
[11] *See* DON IHDE, D. TECHNOLOGY AND THE LIFEWORLD: FROM GARDEN TO EARTH. (3rd. ed. Bloomington: Indiana University Press 1990).
[12] *See* Don IHDE. POSTPHENOMENOLOGY AND TECHNOSCIENCE: THE PEKING UNIVERSITY LECTURES (New York: State University of New York Press 2009).
[13] *See* Lambros Malafouris, *Metaplasticity and the human becoming: principles of neuroarchaeology*. 88 Journal of Anthropological Sciences, 49 49–72(2010); *See also* LAMBROS MALAFOURIS, *Knapping intentions and the marks of the mental,* in THE COGNITIVE LIFE OF THINGS: RECASTING THE BOUNDARIES OF THE MIND 13 13–22 (L. Malafouris & C. Renfrew eds., Cambridge: McDonald Institute for Archaeological Research (2010); Lambros Malafouris, *Grasping the concept of number: How did the sapient mind move beyond approximation?* in THE ARCHAEOLOGY OF MEASUREMENT: COMPREHENDING HEAVEN, EARTH AND TIME IN ANCIENT SOCIETIES 35 35–43 (C. Renfrew & I. Morley eds., Cambridge: Cambridge University Press. 2010).

ability to make tools to make tools, and indefinitely causing variations in the manufacture.[14] In fact, the foundational premise of Material Engagement Theory is that functional anatomy of human intelligence is a dynamic construct remodelled in detail by behaviourally important experiments.[15] Recognition of the galvanizing power and potential of technical mediation, on how we see ourselves while trying to figure out the world, lies at the intersection of material engagement theory and post-phenomenology.[16] Parallels can also be found in the *transactional ontology* of the relationship between mind and material world in the discipline of philosophy and cognitive science.[17]

Idhe dives into the phenomenology of human machine relationship and divides this synergy between human beings with tools/technologies into four categories, namely *embodiment relations*, *hermeneutic relations*, *alterity relations* and *background relations*.

EMBODIMENT RELATIONS

Idhe, before entering into the realm of dealing with convention of, invention of, building of, other possible human machine relations discusses the expanse of the pre-phenomological human-machine relations with which are faced in our everyday life.[18] The penetration of technology can be realized once we reflect consciously on our everyday routine.[19] We will find ourselves in the pervasiveness and diaspora of techno-zone everywhere that is undertaken in our daily lives.[20]

Let's take a very specific example from my every day pre-phenomenological encounter with the machines. I take a pencil and write something on a notebook. If I carefully scrutinize my experience, I will find that the pencil that I used to write on the page lets me experience the page

[14] HENRI BERGSON, CREATIVE EVOLUTION (Arthur Mitchell trans., Cosimo Classics 3rd ed. 2005) (1911).
[15] Karenleigh Overmann, *Materiality in Numerical cognition: Material Engagement Theory and the counting technologies of the Ancient Near East.* DPhil thesis, University of Oxford, Oxford. (2016).
[16] Ihde, *supra* note 4, at 03.
[17] FRANCISCO J. VARELA, ELEANOR ROSCH AND EVAN THOMPSON THE EMBODIED MIND: COGNITIVE SCIENCE AND HUMAN EXPERIENCE. (Cambridge: MIT Press 1991); ANDY CLARK, BEING THERE: PUTTING BRAIN, BODY, AND WORLD TOGETHER AGAIN (Cambridge: MIT Press 1997); ANTHONY P CHEMERO RADICAL EMBODIED COGNITIVE SCIENCE. (Cambridge MIT Press 2011); DANIEL D. HUTTO, AND ERIK MYIN, E. RADICALIZING ENACTIVISM: BASIC MINDS WITHOUT CONTENT (Cambridge: MIT Press 2013); Shaun Gallagher ENACTIVIST INTERVENTIONS: RETHINKING THE MIND (Oxford University Press 2017).
[18] Praxis, at 6.
[19] *Ibid.*
[20] Praxis, at 7.

(features like textures, softness). The intentional extension of my being is transmitted into the paper via the pencil (terminus) and I discover that touch is also a distance sense. On the phenomenological level, the pencil is only secondarily an object, while more primarily it is transformed into my experience as extension of myself. The tool is an 'intermediary' between me and what is experienced, and is in this sense a 'means' of experience in the primary focus.[21] Idhe represented this in the following notation:

(Human-machine) -> World

Similar relations can be felt across widespread human-machine relations. The seasoned car driver when parallel parking needs very little by way of visual clues to place the car in the small place – in fact, he 'feels' the extension of himself through the car as the car becomes the symbiotic extension of his own embodiness.[22] Idhe has named such kind of relations as 'embodiment relations.' Embodiment relations are those in which the machine acts as a mediator between my object of experience, and this is in contrast to my ordinary experience in the "flesh".[23] This relation result in the reduction of my experience in certain ways. First, this is clearly a reduction of my full range of my globally sensory experience of the other, i.e. there is a quasi or transformed presence. This phenomenological description can have vital repercussions when we are considering Brain-Machine Interface devices like Neuralink. What is important is emphasise in the difference between naked sensory experience and machine-mediated experience, is that there is cross-sorting which leads to proliferation of *ambiguity* in relation to the interacting agents.[24] The world comes to become a spectacle taking us away from its unsullied purity.[25]

HERMENEUTIC RELATIONS & HEIDEGGER'S ONTOLOGICAL DIMENSIONALITY

Idhe describes Hermeneutic relation is the second category of relationship wherein we move from experiencing through machines to experiencing of machines.[26] For example, let us consider the techno-laden environment existing in an automobile manufacturing factory.[27] I will come across a basement that is filled with dials, gauges, robotic arms, switches and other equipment. On most occasions, the worker sitting in the control centre

[21] Praxis, at 8.
[22] *Ibid.*
[23] Praxis, at 9.
[24] Praxis, at 11.
[25] *Ibid.*
[26] *Ibid.*
[27] Praxis, at 12.

monitors all the heating and cooling systems and functioning of the robotic arms. The worker in this case '*reads*' the dials to see the arms are functioning normally, and if they aren't, he merely has to turn a dial and see if the arms are beginning to turn to normal. Here the engineer is engaged in the *experiences* of a machine. Idhe modelled this relationship as:

Human → (machine-World)

Metaphorically speaking, hermeneutic relations are like text in a novel. I may read an author but the author is indirectly present in the text.[28] It is precisely in these situations that Kafkaesque situations may arise.[29] For example, consider the situation in which the dial has gone faulty and the worker thinks that robotic arm is going right instead of it going left. It is precisely the instruments, which probe the ultramicroscopic worlds of the atom and leave room for doubt as to what is precisely is 'on the side' of the machine.[30] In case of hermeneutic relation, our object of attention is the artefact while conversely in the case of embodiment relations the artefact acts as a mediator at our natural object of attention.[31]

Similarly, Heidegger too goes one step ahead, and applies his *ontological comprehension* of truth (Truth is revelation of some 'obscureness' that is bought to presence within some opening which itself has a form) to machines and says that technology has *a priori ontological relation* to Science.[32] Contrary to existing notion that technology is a means to our end, his *ready to hand* reasoning is of the form that the world is *revealed* through the (a) equipmental context; (b) equipmental context is the condition of the possibility of the specific tools which they are; (c) equipment of hand through readiness-to-hand reveals existential intentionality and (d) context is taken holistically conception.[33] Essentially, in hermeneutic relations, the machine becomes the 'other', as a focal object of experience thus leading to unintended and unimaginable possibilities.[34] Heidegger does not merely trace this revelation to a dimension -specific equipmental context. For example, a light bulb in a room subsumes the darkness, a covered road-side

[28] *Ibid.*
[29] *Ibid.*
[30] *Ibid.*
[31] Richard Heersmink, *Ghost in the Machine, A philosophical analysis of the relationship between brain-computer interface applications and their users,* 2008, at 60. [Hereinafter Ghost].
[32] *Id., at* 126.
[33] *Ibid.*
[34] Ghost, at 12.

bus stop takes account of the rain and thereby alters the holistic reality in the proces.

By application of Heidegger's ontological dimesionality of technology, it can be safely said that BCI like Neuralink would provide the *equipmental context* for the realization and revelation of our existential intentionality in the coming future. A fortiori, we will discover parts of ourselves that has been hidden to us since time being.

ALTERITY RELATIONS

This relationship is concerned with how we relate to technology as another being.[35] This *otherness* remains a quasi-otherness.[36] The threshold of this otherness remains weaker than the one we experience with animals. So if we see someone posting a status with their earphones, it signifies a strong alterity relations of the user with their technology. This is why we have a tendency to personalize our assets and we are enthralled by technologies that are like us.[37] Idhe denoted denoted it as[38]:-

Human -> Technology

The stronger our affiliation, the greater the alterity relation is.[39] That is why we seem to personalize our devices to our liking and have an intuitive regard for certain types of technologies that remind us of ourselves. Robots also fit into the same criteria. We have different kinds of alterity relation with different kinds of technologies.

BACKGROUND RELATIONS

This is the kind of relationship in which tools/machines are pushed into the background.[40] For example, technologies like lighting, heating and cooling systems & washing machine operate without any human intervention in the context of their functionality. Generally, it does not require direct human intervention, although they do condition the holistic context in we live. Idhe proposed the following notation for it[41]:-

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[35] Ghost, at 61.
[36] *Ibid.*
[37] Aboulafia, Mitchell, "George Herbert Mead", *The Stanford Encyclopaedia of Philosophy* (Edward N. Zalta ed.) Retrieved from https://plato.stanford.edu/archives/spr2020/entries/mead (last visited Jan 12 2021); *See also* ERVIN GOFFMAN PRESENTATION OF SELF IN EVERYDAY LIFE (Anchor 1959).
[38] Ghost, at 63.
[39] Ihde, *supra note* 10.
[40] Ghost, at 62.
[41] Ghost, at 63.

(Machine-world) – Human

As pointed out above, devices like Neuralink that extract brain activity of the user and convert it into command signal for current applications like motorized wheelchairs, prosthesis and computers and many more potential applications advance the embodiment relations of machines with our human senses.[42] While manipulating devices with our thoughts remain still in the sphere of fiction, BCI technologies are being used today for medical reasons while possessing the potential for far-reaching applications.[43]

VEERBACK'S CYBORG INTENTIONALITY

Veerback's concept of cyborg intentionality, specifically *Hybrid intentionality* is relevant when we want to build a conceptual hybrid framework for Neuralink.[44] Veerback essentially contextualizes the term, 'cyborg' and makes the point about the human intentionality that is constituted by technology.[45] His cyborg intentionality is classified into three types:-

- Mediated intentionality – This is used to express the phenomena that most of the relations we have with the world around us is either directed at or facilitated by technological devices and artefacts.[46] Parallels of this category can be drawn to Idhe's concept of *embodiment relations*.[47]
- Hybrid intentionality – This category refers to the actual merging, rather than any intermediated interaction, of the human with the technological.[48]
- Composite intentionality – This category refers to the "addition" or "interplay" between human intentionality and intentionality of technological artefacts themselves.[49] For example, the thermostats' directness with respect to measuring temperature

[42] Ghost, at 9.
[43] *See* Shih JJ, Krusienski DJ, *Wolpaw JR. Brain-computer interfaces in medicine* 87 (3) Mayo Clin Proc 268 268-279 (2012).
[44] Peter Paul Verbeek, *Cyborg intentionality: Rethinking the phenomenology of human–technology Relations* 7(3) Phenomenology and the Cognitive Sciences 387–395 (2008). [Hereinafter Cyborg Int].
[45] Homofaber, at 208.
[46] Homofaber, at 208.
[47] Praxis, at 8.
[48] Homofaber, at 208.
[49] *Ibid.*

enables human directness with respect to determining the temperature of the ecosystem.[50]

In the context of BCI like Nerualink, Veerback's concept of *Hybrid intentionality* seems to be squarely applicable as the BCI will require an interplay between human intentionality and intentionality of the interface of invasive electrodes that could potentially alter cognitive processes. Moreover, this will also enable computer devices & human brain to transfer information in both the directions. It is in that process that there would be invocation of brain states with invasive electrodes that would relate to certain mental representations which would thus create *hybrid intentionality*.

What is fascinating is that for the first time we would invoke cognitive process by artificial means going beyond our senses to acquire information.[51] The far sighted implication of such a hybrid state would be that we wouldn't need our senses anymore to obtain information. This hybrid intentionality would represent a "sixth sense" that could have drastic consequences for the structuring of our cognitive system.[52] This could be akin to a situation wherein we are plugged in to a machine while deriving the maximum hedonistic pleasure out of it.[53]

III. NORMATIVE HARMS – TRANSHUMINISTIC CONFIGURATION

AUTONOMY & PRIVACY

The Right to be let alone is the foundational premise of the notion of privacy[54] encompassing the aspect of mental privacy. The idea of mental privacy implied that the contents of one's mind remained hidden to one's mind until they were voluntarily disclosed.[55] However, the technological advances of today have already led to the impairment of the erosion of this mental privacy.[56] With the influx of social media platforms and surveillance-propogating technologies, the inner sanctum of mind has been *ontologically*

[50] *Ibid.*
[51] Ghost, at 74.
[52] *Ibid.*
[53] Ghost, at 75.
[54] Samuel D. Warren; Louis D. Brandeis, *The Right to Privacy* 4 (5) 193 193-220, Harvard Law Review (1890).
[55] Adina Roskies, "Neuroethics", *The Stanford Encyclopedia of Philosophy* (Edward N. Zalta ed., Spring 2016 ed.) Retrieved from https://plato.stanford.edu/archives/spr2016/entries/neuroethics (last visited at Jan 12, 01, 2021).
[56] *Ibid.*

revealed to the outside world, intruding upon a person's emotional well-being.[57]

With the potential creation of BCI devices like Neuralink, the threat to privacy is not a shallow claim about devices that are able to read our thoughts, although this could prove to be a dyastopian scenario in the future.[58] Framing of the infringment to any potential privacy claim has to be based in an empirical grounded evaluation of the real nature of threat. For example, devices that ascertain honesty or dishonesty based on brain-patterns raise a host of legal issues in relation of their deployment in employment or as evidence in the court-room.[59] Similarly, the deployment of Brain-machine interface inadvertently leading to hybrid intentionality would also raise potential claims about erosion of our mental privacy and thus degrading our sense of self and dignity.[60]

Another potential concern that could stem from deployment of Neuralink is on the person's sense of autonomy. Autonomy is one of the most valuable aspects of personhood.[61] Our thoughts and behaviour are manipulated indirectly by old worries induced by propaganda and subliminal advertising.[62] In the same way, devices like Neuralink bear the potential to control our threats or behaviour which directly touches on our sense of autonomy.[63]

SURVEILLANCE & COMMODIFICATION OF INTIMATE DATA

[57] Judith DeCew, "Privacy", *The Stanford Encyclopedia of Philosophy* (Spring 2018 Ed.), Edward N. Zalta (ed.) Retrieved from https://plato.stanford.edu/archives/spr2018/entries/privacy/ (last visited at Jan 12, 01, 2021); *See also William* Prosser, *Privacy*, 48(3) California Law Review 383 383-423 (1960).
[58] Roskies, *supra* note 54.
[59] Joshua D Greene , Leigh E Nystrom, Andrew D Engell, John M Darley, Jonathan D Cohen, *The Neural Bases of Cognitive Conflict and Control in Moral Judgment* 44(2) Neuron 389 389–400. (2004).
[60] *Ibid*; *See also* Adam D. Moore *Defining privacy*. 39 Journal of Social Philosophy 411 411–428 (2008); M Roth. *CMU knows what's on your mind* Pittsburgh Post-Gazette (2009) Retrieved January 4, 2009, Retrieved from http://www.post-gazette.com/science/2009/01/04/CMU-knows-what-s-on-your-mind/ stories/200901040263 (last visited at Jan 12, 01, 2021); I Sample, *Mind-reading program translates brain activity into words*, The Guardian. (2012). Retrieved from http://www.theguardian.com/science/2012/jan/31/mind-reading-program-brain-words (last visited at Jan 12, 01, 2021); P. R Wolpe, *Is My Mind Mine?* Forbes (2009). Retrieved September 10, 2009, from http://www.forbes.com/2009/10/09/neuroimaging-neuroscience-mind-reading-opinions contributors-paul-root-wolpe. html. (last visited Jan 12, 01, 2021).
[61] Roskies, *supra* note 54; *See also* A. RIP STEIN. EQUALITY, RESPONSIBILITY, AND THE LAW. (Cambridge University Press, New York 1999).
[62] Roskies, *supra* note 54.
[63] Ibid.

Haggerty and Ericson proposed the concept of *surveillance assemblage* for which they have contextualized the idea of *assemblages* as proposed by Deleuze and Guattari.[64] The post-panoptic assemblage is directed towards hybrids – technology-information assemblage and therefore this concept could be squarely deployed to criticize the neo-liberal control implications of devices like Neuralink.[65] The device bears the potential of expanding profit & control by corporations who will benefit from the sharing and transmission of data.[66] This device could then be deployed by the interested stakeholders for the purpose of technologically controlling and disciplining workers while the corporations that exercise control over such device would profit from such an arrangement. New structures of power and knowledge would be produced when an individual's thought and behaviour is being modulated and altered before he knows it himself.[67]

THOUGHT-POLICE – INTERFERENCE WITH LIBERTY

Neuroscience intervention can affect out primal instincts, desires, moods, impulses and other elements that are regarded as basic and have the potential to alter the meaning and quality of the most intimate aspect of our lives.[68] Our brains are a proximal cause of who we are and what we do. One of the conception of personal identity hinges on what makes one person numerically identical to another person at another time.[69] Per Hart, it is our organic shared history that makes us who we are.[70] However, with devices like Neuralink there could be imposition of artificial psychological continuity for two human beings for the benefit of corporations. The modulation of our

[64] Kevin D. Haggerty & Richard V. Ericson, *The Surveillant assemblage* 51(4) British Journal of Sociology, 605 605–622 (2000); *See also* Masa Galic & Tjerk Timan, *Bentham, Deleuze and Beyond: An Overview of Surveillance Theories from the Panopticon* 30 (1) Philosophy & Technology 9 9-37 (2017).
[65] Galic *ibid.*
[66] *See* Karim Jebari *Brain Machine Interface and Human Enhancement – An Ethical Review* 6 Neuroethics 617-625 (2013); *See also* Ienca, M. & Haselager, P. *Hacking the brain: Brain–computer interfacing technology and the ethics of neurosecurity.* 18(2) Ethics and Information Technology, 117 117–129. (2016).
[67] *See* Shoshana Zuboff *Big other: surveillance capitalism and the prospects of an information civilization*. 30 Journal of Information Technology, 75 75–89 (2015); *See also* Bellamy Foster, J. & McChesney, R.W. *Surveillance Capitalism: Monopoly-Finance Capital, the Military-Industrial Complex, and the Digital Age.* 66(3) Monthly Review (2014).
[68] Roskies, *supra* note 54.
[69] *Ibid.*
[70] *See* H.L.A HART CONCEPT OF LAW (Oxford Claredon Press 1961); *See also* ERIC T OLSON, THE HUMAN ANIMAL: PERSONAL IDENTITY WITHOUT PSYCHOLOGY (New York: Oxford University Press. 1999).

thought leads to loss of our agency and is an indirect infringement of our liberty.

IV. BCI - REGULATORY APPROACHES & PRINCIPLES

In the realm of the interposition of ethics and innovative technologies, the challenge in regards to a regulatory framework does not depend upon in providing solutions of new & unexplored issues but in dealing with limitations of regulatory systems that developed over the years and ensuring their effectiveness.[71] Any regulatory intervention should focus on the identification of leverage points (specific-jurisdiction) at which precisely to intervene.[72] In the context of novel technologies, this would involve the nuances in the identification of how far and how well the existing regulatory technologies would apply to BCI devices like Neuralink.[73] The precise points where the regulatory framework is being constricted or bottlenecked, interventions should be applicable.[74] This can be achieved by mapping the landscape of these regimes and the responsible authorities involved in such an intervention.[75] Afterwards, there should be a jurisdiction-wise specific analysis in consideration of the fact that whether these the regime is ensuring *effective* and *proportionate* oversight or not? The scope of framework should cover the ambit of innovators, manufacturers, subjects as well as the respective economic interests of stakeholders interested in the design and delivery of stakeholders.[76] Finally, the ultimate objective of the regulatory framework should be to deliver the benefits of the innovation with minimum regulatory burdens so long as requirements of proportionality and safety are being met.[77]

Moreover, BCI technologies like Neuralink involve the complex architecture of technologies, risks and benefits in the implementation of novel technologies & therefore it is impractical to lay down a set of prescriptive principles and expect them to be carried down. The agrandizzing hype about potential of BCI in light of practical utilitarian need raise considerable conoundrums for policymakers. The Regulatory framework concerning BCI should consist of three criteria; *firstly* the underlying

[71] Ghost, at 131.
[72] *See* Donella Meadows & Diana Wright THINKING IN SYSTEMS: A PRIMER 145 (Chelsea Green Publishing Co. 2015).
[73] Ghost, at 131.
[74] Ghost, at 131.
[75] *Ibid.*
[76] *Ibid.*
[77] *Ibid.*

principles driving the framework, *secondly* the normative basis of virtue underpinning any plan of action or intervention[78] and *thirdly* the interests & the policy goals associated with unintended consequences resulting from the application of the device as discussed above.

FOUNDATIONAL & UNDERLYING PRINCIPLES

There is a constant flux between the benefits and the uncertainty which lies at the root of our framework. While the emotional distress and turmoil caused by brain disorders entail the necessity of an effective intervention, however on the other hand, there is an ambiguity about the proclaimed benefits and repercussions associated with BCI.[79] This ambiguity arises due to the lack of any comprehensive understanding regarding the functioning of the brain.[80] Correspondingly, the foundational principles must inculcate *beneficence* of intervention by these technologies only when the applicable benefits have been demonstrated to sufficiently apply while simultaneously providing for *caution* on account of uncertainty in the potential benefits of applicability. Moreover, any regulatory framework should *mitigate* any risks associated with the hedonistic pleasure as derived from the virtual experience provided by Neuralink, although Nozick argues that humans value the contact with reality in itself as we actually want to 'do' things rather than simply having the experience of doing them.[81]

NORMATIVE BASIS : VIRTUE GUIDED APPROACH

Any meaningful policy framework must be reinforced with principles of virtues.[82] Aristotelian ethics form the basis of virtue ethics, that places particular emphasis on moral character.[83] The elements of virtue that should guide policymakers include[84] :-

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[78] Ghost, at 19.
[79] *Ibid.*
[80] *Ibid.*
[81] Ghost, at 75; *See also* ROBERT NOZICK ANARCHY, STATE, AND UTOPIA. 42-45. (Basic Books 1974).
[82] Aayush, *Tech-Policy | Policy Risk Assessment: Neuralink & Brain Control Interfaces* Retrieved from https://medium.com/per-pro-schema/tech-policy-policy-risk-assessment-neuralink-brain-control-interfaces-637677f03d26) (last visited Jan 12 2021).
[83] Hursthouse, Rosalind and Glen Pettigrove, Virtue Ethics, *The Stanford Encyclopaedia of Philosophy,* (Edward N. Zalta ed. winter 2018 Edition URL = https://plato.stanford.edu/archives/win2018/entries/ethics-virtue/ (last visited 12 Jan 2021); *See also* ROSS D THE NICOMACHEAN ETHICS 467 (Oxford: Oxford University Press 2009).
[84] *Novel Neurotechnologies, intervening in the brain* (Nuffield Council on Bioethics 28 Bedford Square London WC1B 3JS 2013). [Hereinafter BCI Report].

- Inventinvess – It must be exercised through, among another means, technological means by identifying the approaches that provide wider access to the beneficiaries of the technology.

- Humility – Acknowleding the limits of the technological progress and a realistic capability of the technology to alleviate brain disorders & other potential benefits.

- Responsibility – Refraining from aggrandizzing claims about the premature applications of such technologies.[85]

Moreover, the reasons why a virtue-guided approach should be preferred are as follows :-

- First, a virtue-enabled approach enables the balance in light of the overarching need and the flexibility that a policy framework requires.[86]

- Second, the idea of virtue ethics itself implies the necessity to use practical judgement to come up with a response that is appropriate to the particular approach required.[87]

- Third, virtue ethics proliferates and promotes interventions not as neo-liberal controllers of our brains but as individuals with particular values, desires, relationships and aspirations.[88]

A virtue guided approach will enable us not only to do the right thing but incorporate our actions in the wider ambit of altruistic perceptions, humble priorities and over-arching values.

POLICY GOALS & INTERESTS – SAFETY, PRIVACY, AUTONOMY & EQUITY

In light of the risks associated with the unforeseeable impacts of BCI during their development, five interests should provide the necessary protection.[89] These interests should ensure the minimization of any potential harm resulting from *privacy* & *autonomy*, both at individual decision-making level and in the wider context of subject's life.[90] The market access of BCI

[85] *Ibid.*
[86] Aayush, *supra* note 81.
[87] *Ibid.*
[88] *See* BCI Report, at 85.
[89] BCI Report, at xix.
[90] *Ibid.*

should be determined in consideration of *equity* while diminishing any stigma while promoting and protecting *public understanding* and *trust* in respect to the *safety* of the device.[91] What is also important is how we frame the policy problem with respect to each of the policy goals.[92]

V. PROBLEM FRAMING & RECOMMENDATIONS

SAFETY – The unintended consequences arising out of the applications of BCI could include their ill impact on health & cognitive brain functions.[93] The presence of foreign objects inside the brain carries associated risks.[94]

RECOMMENDATIONS – Onus of responsibility should be placed on the developers to provide cogent proof that takes into account the risk/benefit ration with available treatment options.[95] Moreover, the regulatory framework should ensure that there is proper publication and dissemination of evidence that is accessible to general public conveying safety in clear and unequivocal terms.[96]

AUTONOMY & PRIVACY – Disruption in our understanding of the notion of free-will[97] as well as disruption of autonomy due to brain disease or injury. Information collected from BCI can be used for identification of subject or other discriminatory purposes.[98] External breach or data theft could have serious repercussions that could have far-reaching impact on the utility of the device.[99]

RECOMMENDATIONS – Promoting the subject's understanding of his autonomy by offering him informed consent.[100] Development of best

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[91] *Ibid.*
[92] Dan Ross, and Annalisa Weigel. Introduction to Technology and Policy. Massachusetts Institute of Technology: MIT OpenCourseWare 2006 Retrieved from https://ocw.mit.edu (last visited 12 Jan 2021).
[93] Tal Dadia & Dov Greenbaum Neuralink: *The Ethical 'Rithmatic of Reading and Writing to the Brain*, 10 (4) AJOB Neuroscience 187 187-189; *See also* Krause, B. M. Dresler, C. Yen Looi, A. Sarkar, and R. C. Kadosh, *Neuroenhancement of high-level cognition: evidence for homeostatic constraints of non-invasive brain stimulation.* 3(1) Journal of Cognitive Enhancement (2019).
[94] Christoph P Hofstetter, Niklas A Holmstrom *Allodynia limits the usefulness of Intraspinal neural stem cell grafts; directed differentiation improves outcome* 8(3) Nature Neuroscience 346 346-53 (2005).
[95] BCI Report, at 79.
[96] *See* BCI Report, at 174.
[97] Tal Dadia, *supra* note 92.
[98] *See* Will Tomas DeVries, *Protecting Privacy in the Digital Age*, 18 Berkeley Tech. L.J. 283 (2003).
[99] E Hildt, *Brain-computer interaction and medical access to the brain: Individual, social and ethical implica*tions 4(3) Studies in Ethics, Law and Technology 1-22 (2010) at 8-9.
[100] BCI Report, at 79.

practices privacy standards by developers that should adhere to applicable data protection standards in the jurisdiction for collection and dissemination of subject's data. Adoption of security standards to protect the device from any external interference, the failure of which could undermine the utility of the device besides the loss of self-reliance by the subject.[101]

EQUITY - Accessibility and availability of device only to the citizens of the upper strata of the society.[102] Moreover, selective treatment can be a cause of discrimination for those who live with neurological & mental health issues as long as these interventions remain novel.[103]

RECOMMENDATIONS – The stakeholders should work together to come up with jurisdiction specific models that combat social discrimination against individuals at societal level.[104] Also, the model for funding should reflect close association between scientific community, the industry & non-governmental organisations.[105]

TRUST - Hype and grandstanding that decreases trust & confidence in BCI if the promises are not matched in reality.[106] Challenges among developers and researchers for conveyance of the limits of current technology in order to secure informed consent to potential users in the backdrop of hype and glitter.[107]

RECOMMENDATIONS – Developers should cultivate responsible communication practices with respect to the limits of realistic capability of BCI. Equally important is the deployment of responsible practices while publication of findings by researchers.[108]

VI. CONCLUSION

This idea of Transhumans signify the next stage of human 'becoming' with the hybrid intentionality at our core. The underlying premise of my

[101] BCI Report, at 83.
[102] *Ibid.*
[103] BCI Report, at 84; *See also* Frederic Gilbert and Daniela Ovadia, *Deep brain stimulation in the media: over-optimistic portrayals call for a new strategy involving journalists and scientists in ethical debates* Frontiers in Integrative Neuroscience 1-6 (2011).
[104] Aayush, *supra* note 81.
[105] *Ibid.*
[106] TE Schlaepfer, S Lisanby and Pallanti *Separating hope from hype: some ethical implications of the development of deep brain stimulation in psychiatric research and treatment* 15(5) CNS Spectrums: 285-7 (2010).
[107] BCI Report, at 84.
[108] Aayush, *supra* note 81.

perspective on BCI technologies has been that fabrication lies at the heart of our existence. We are both changing as well as being changed by innovations of technology, the sheer quantity, variety and magnitude of our dependency on the techno-material. Human material can be accounted basis technical mediation & creative engagement while the resulting oversight should ensure appropriate safety and precaution in the regulatory landscape. It's time that we update our understanding of what it means to be human.