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BRAIN STIMULATION IN THE NORMAL POPULATION AS A CASE ON HUMAN ENHANCEMENT

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1 INTRODUCTION

Transcranial magnetic stimulation (TMS) is a technique used to stimulate brain areas. TMS is FDA approved to treat depression, migraines, OCD and smoking cessation (Cohen et al., 2022).
Because promises are piling up (see Section 1.1), it may be useful to have a closer look at this technology. I frame TMS as the *panacea* it is claimed to be by advocates, even though this may be inaccurate — assuming sufficient evidence becomes available or alternative technologies improve to the extent they can fulfil these promises.
This is reasonable as similar technologies[1] also try to find ground in clinical practice, such as transcranial direct current stimulation (tDCS), focused ultrasounds, temporal interference stimulation, near-infrared optogenetic stimulation and nanomaterial-enabled magnetic stimulation (Liu et al., 2022; Mahoney et al., 2020). These technologies have two characteristics in common: (1) they stimulate specific parts of the brain to enhance or mitigate activity in that area and (2) they are minimally invasive — using magnetic or electrical currents that do not require any surgical procedure. This paper assumes these characteristics uphold in future developments.

1.1 *Cosmetic Brain Stimulation*

Setting the frame like this, allows us to look past contemporary issues and look at the implementation of *cosmetic brain stimulation in the normal population*. I acknowledge this burdens me to specify which traits have sufficient evidence to build upon[2]. I do so along three axes: cognition, mood and moral judgement.

[1] For simplicity, I do not explicitly differentiate between these technologies.
[2] I do not claim these uses are sufficiently *proven* since they are not. I do think these uses have the *potential to become proven* in the near future because some studies already show effects in specific populations (e.g. older adults). I acknowledge this is speculative, which is why I use them as examples instead of part of my structural analysis.

Firstly, cognitive enhancements relate to improvements in working memory, complex motor tasks, language learning and creative thinking. Working memory improvements were found in a meta-analysis in the context of learning (Mancuso et al., 2016) and latent working memory (i.e. the ability to hold information in one's working memory; Rose et al., 2016). Applications can be useful in the context of remediating cognitive ageing effects (Indahlastari et al., 2021).
Another meta-analysis shows brain stimulation improves motor skills in older adults (Summers et al., 2016). Examples of improved motor skills are enhancement in speed and motor control (Panouillères et al., 2015).
In the domain of language learning, brain stimulation has shown interesting results, improving fluency and word learning (Price et al., 2015). This indicates learning, in general, may enhance due to brain stimulation.
Other studies show an increase in creative thinking after brain stimulation, where people become better able to come up with novel, original and suitable ideas (Hertenstein et al., 2019; Lucchiari et al., 2018). There even are reported cases where people became *artistically able* after brain stimulation (e.g. Simis et al., 2014).

Secondly, brain stimulation to treat depression is effective according to a multifold of studies (e.g. Gershon et al., 2003), which has led to approval and clinical use. Underlying mechanisms may extend to normal populations — as brain stimulation improves emotional regulation and social skills, and mitigates fear responses (Lantrip et al., 2017).

Thirdly, several studies show an alteration of moral judgement on utilitarian reasoning, principlism, risk-taking and honesty.
Although the effects on utilitarian reasoning are ambiguous — with studies claiming brain stimulation decreases utilitarian reasoning (Kuehne et al., 2015; Zheng et al., 2018), whereas another study found the opposite effect (Ye et al., 2015) — these studies do show *an* effect on moral judgement.
The weight given to principles also tends to change, as Knoch et al. (2006) show an alteration in perspectives of unfairness, where people had diminished *reciprocal fairnes*s (i.e. punishing others' wrongful behaviour at cost of their own interests) after brain stimulation. On top of that, brain stimulation also diminishes risk-taking tendencies (Fecteau et al., 2007).
On honesty, multiple studies report that brain stimulation leads to better capability of deceptive responses (Fecteau et al., 2013; Sellaro et al., 2016) and making honest and deceptive responses more similar in terms of cognitive workload (Sánchez et al., 2020). This contrasts with Fan et al. (2020), who show that corruption tendencies decrease with brain stimulation. An important nuance here is brought by Karton and Bachmann (2011) — who state that depending on whether the left or right hemisphere is stimulated, the tendency

to lie increases or decreases respectively. This principle is known as the *zero-sum model*, where enhancement always comes at the cost of mitigating another area within the brain (Brem et al., 2014). This means that enhancement offers flexibility and that all effects have a counterpart under this model.

1.2 *Enhancement in the Normal Population and its Relevance*

Promises on what brain stimulation can do are prevalently portrayed in public discourse by science fiction. The value of such discourse is ambivalent, where on the one hand the rise of brain stimulation technology may allow some of the portrayed promises to become fulfillable, while the majority of promises are simply not in sight.

However, brain stimulation is no longer solely science fiction. Therapeutic interventions already extend to treating several pathologies (clinics advertise TMS as treating autism, PTSD, bipolar disorder, cognitive impairment or Parkinson's disease; Wexler et al., 2021), as well as beyond this. For example. The US military has tested tDCS to enhance[3] multitasking and learning capabilities (Clark et al., 2012; Nelson et al., 2016).
Apart from professional implementation, brain stimulation communities are already using tDCS technology at home (Jwa, 2016). Being on the edge of a breakthrough may be the ideal moment to discuss the underlying considerations and assumptions for the implementation of this technology. Accordingly, I answer two questions in this paper.

RQ1 *What are the ethical considerations in making brain stimulation available within the normal population?*

RQ2 *What are the assumptions about normality in these considerations and how are they altered through implementation?*

2 BRAIN STIMULATION AND ITS ETHICAL CONSIDERATIONS

Intuitively, significant benefits can be gained from brain stimulation since this technology allows humans to become better learners, possess better motor skills, improve creativity, increase happiness or even become better moral subjects. On the other hand, some ethical considerations do require discussion. I discuss those along four axes: safety, character, justice and autonomy.

[3] I define enhancement as the opposite of *therapeutic intervention*. Consequently, therapeutic intervention aims to either *repair something broken* or *remedy a dysfunction* (Sandberg, 2014). This definition already makes assumptions about normality, which is why I contest it in Section 3.1. However, I think this is an intuitive starting point for our discussion.

2.1 *Safety*

Both reviews on TMS and tDCS found minor side effects from treatment, with the most prevalent being a transient headache (Poreisz et al., 2007; Rossi et al., 2009). However, there are reported cases of histotoxicity or structural brain changes in the case of repeated TMS, as well as seizure risk for epileptic patients (Rossi et al., 2009). This shows the relative safety of using these technologies in most settings, but gives reason to be sceptical about the safety of intervention when repeatedly used (*the build-up effect*; Davis & van Koningsbruggen, 2013).

On top of this, two other considerations require discussion (Levasseur-Moreau et al., 2013). Firstly, the majority of research focuses on clinical practice which may not be extendable to normal populations. For instance, treating depression with brain stimulation helps to inhabit a depressive mood, but would also hinder mood in the normal population. Secondly, functions are not independent and stimulating one area of the brain inhibits others (Brem et al., 2014). For this paper, I assume these safety concerns will be sufficiently studied and tackled.

A more fundamental point is to be made on informed consent — the question of whether people possess sufficient knowledge about the procedure (Scheper et al., 2022, pp. 14) and how consent holds in relation to a character when altered by brain stimulation (Cabrera et al., 2014, pp. 9).

2.2 *Character*

As the reader may recognise, some of the traits discussed in Section 1.1 lean towards a tenuous area of character. That brings three points of consideration. Firstly, whether it is appropriate to alter traits that we normally identify as part of the self. One study found that people believe traits such as creativity and even mood are fundamental parts of the self and 70% and 79% of people, respectively, would not alter those traits when given the chance. On the contrary, language learning skills and memory enhancement were thought of as less fundamental to one's character (Riis et al., 2008). Even though a survey is not a moral guide for which traits to enhance, it suggests that intuitively we think some traits are more inherent than others. The question primarily becomes, when does someone become a *different* person?

Secondly, a fundamental concern is that this alters the meaning and uniqueness of traits gained by the *natural lottery* or hard work. One can see how the appreciation of for example art and creativity might decline if people generally become more artistically able through brain stimulation. Sandel (2007, pp. 26-27) argues that enhancement destroys the appreciation of the received characteristics and the achievements made possible through human dedication, as well as natural giftedness. This erodes the exact things we appreciate in such traits, to the extent that they are relative and unique. For example, honesty may be an absolute trait that nevertheless is valuable even though most humans would possess it. This may be different for creativity, which has a more relative character (see Section 2.3). This spectrum of absolute and relative traits should be of consideration in this concern.

Thirdly, altering traits may affect other characteristics in indirect or unintended ways. Hamilton et al. (2011, pp. 190) bring this argument, pressing on the fundamental role of physical and psychological discomfort, which helps to develop traits such as patience, determination, empathy or for example feeling accomplished when one overcomes hardship. Even though it seems intuitive that it would be good to *smooth out* a bad mood, this ignores fundamental reasons why someone is having a bad mood, as well as the positive side of having a bad mood being that someone can use pain as a learning process (*the no pain, no gain belief*; Chatterjee, 2007). We know alike arguments from criticism on SSRI medication, although it is differentiated since the normal population by definition does not suffer from depression, anxiety or otherwise require treatment.

2.3 *Justice*

Distributive justice is a concern that is built on the notion that someone's well-being is not only determined by absolute welfare, but also by someone's relative position in society (Chatterjee, 2018, pp. 124). For example, the reason you have a place in society as an artist is that you are artistically able *relative to the rest of society*.

In the context of brain stimulation, the consideration becomes evident given that this technology would either be reimbursed or not reimbursed. In the case of reimbursement, this requires groups that practically or principally abstain from stimulation to pay for those that do not. In the more likely case of no reimbursement, this technology may become inaccessible for poor groups, hence, widening the gap between poor and rich groups in society. In both cases, one group gains an unfair advantage at the expense of the other group. On the other hand, this consideration is not unique to brain stimulation (e.g. provision of a healthy diet or a silent place to study leads to an identical argument). Therefore, it is hard to differentiate brain stimulation as fundamentally different on a relevant axis. On top of that, tDCS technology is relatively cheap and may in that sense be more comparable to a smartphone (Cabrera et al., 2014, pp. 11-12).

2.4 *Autonomy*

Regarding autonomy, ethical considerations arise on both explicit and implicit coercion. Explicit coercion may occur in a clinical context (e.g. treatment of anorexia nervosa; Maslen et al., 2015), but this exceeds the scope of this paper. Nevertheless, there are situations where stimulation tends towards explicit coercion. For example, in the hypothetical case where a job as an air controller in the military requires brain stimulation. Here there is a conflict between the military's obligation to reduce the risk of accidents and the bodily autonomy of a person (Lapenta et al., 2014, pp. 177-178).

Implicit coercion occurs whenever the environmental pressure to use technology alters the autonomy of a person. In the context of brain stimulation, people may feel coerced to interact with this technology to *keep up with the competition*. This *because everyone does it* argument undermines a real opt-out opportunity if the only opt-out option being offered comes at a high cost (e.g. not interacting means you are less capable of memorisation or focus, making it harder to work in a significant number of areas). Such effects are already shown by Greely et al. (2008), where up to 25% of students on some campuses use prescription stimulants to enhance their focus. This alters the pressure and expectations of a general student when many students participate in this behaviour (i.e. the *normal* student).
One can imagine brain stimulation being used in similar ways, for example, students *zapping* to enhance their working memory right before an SAT (Steven & Pascual-Leone, 2005, pp. 208-209). This also refers back to our previously discussed notion of informed consent, which is undermined through coercion.

3 BRAIN STIMULATION AND ITS ASSUMPTIONS OF NORMALITY

So far I begged the question of normality because a discussion of ethics is not possible without assumptions on normality, treatment and enhancement. Thereby, I built a case based on intuition without providing an answer to what is and what is not an enhancement. Now that the impacts are clear, I contest these definitions by exposing their underlying assumptions. I do so along three questions: (1) what is treatment? (2) when is something enhanceable? and (3) how is this altered through widespread implementation?

3.1 *The Purpose of Treatment*

Our starting point has been the definition of Sandberg (2014), who defines treatment as repairing something broken or remedying a dysfunction. This definition is anything but helpful, as it begs the question towards defining what is broken or dysfunctional.

By most definitions, treatment ought to meet unmet needs to become healthy, which brings in the World Health Organization (WHO) definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (1948). Well-being, according to the WHO (2022, pp. 30), extends towards coping with life, *realising their abilities*, learning and working *well* and contributing to their communities. Note how this definition explicitly includes realising someone's abilities or learning and working well.
There are two arguments against its use in the context of brain stimulation. Firstly, this holistic definition — which exceeds the simple absence of pathologies — becomes problematic in the context of brain stimulation. To that end, you would never *be healthy* unless you participate and there is arguably no concept of enhancement. Secondly, this definition assumes there is a concept of *maximum abilities* (i.e. someone lives up to his maximum potential). It becomes ambiguous whether someone has an ability, even though it is accessed by stimulation. This makes the WHO definition inherently problematic.

A second definition is offered by the biostatistical theory (BST). BST abstains from value judgements and refers to *statistical normality* (Boorse, 1977). Consequently, enhancement would be the concept *beyond the average* (see Figure 1) [4].

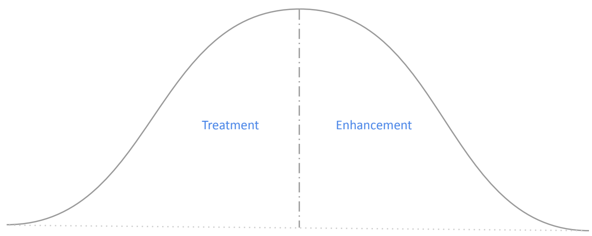

Figure 1: Simplified representation of BST definition in the context of enhancement

However, excluding any moral judgement from this definition ignores considerations of character (see Section 2.2). Increasing honesty may be called enhancement under the BST definition, but that does not mean it is abnormal to be more honest than average. Secondly, Boorse (1977) argues moral judgement is unnecessary for the definition, but this does not tackle the intuitive discomfort we feel in altering creativity. Even if it is not problematic, it is at least unhelpful to exclude moral values.

[4] Note how more or less enhancement in the general population also impacts the *normal* (see Section 3.3.

As a third approach, I bundle Nordenfelt's *vital goals* and positive health (Huber et al., 2011; Nordenfelt, 2007), as they both refer to how actors can fulfil their societal role. This makes health dependent on societal expectations and infrastructure. As discussed in Section 2.4, those dependencies can become problematic when they impose the assumption of compliance on individuals. Hence, when brain stimulation becomes prevalent, these definitions would give a reason to treat individuals to the point where they can fulfil their societal role again.

In general, these definitions either beg the question and assume average or at least fixed minimal abilities that one needs to act in society. This makes an individual subject to societal behaviour, transforming the question of enhancement into a *popularity contest*.

3.2 *The Assumptions of Enhanceability*

One fundamental assumption I made thus far is that we need a strict distinction between treatment and enhancement. This assumption is defended by Sandel (2004), which distinguishes enhancement as an attempt to master nature, open the unbidden and reject the giftedness of life. In this sense, enhancement is framed as *rejecting the natural*. This case against enhancement is contrasted with medical treatment which *honours nature*. Enhancement becomes a symptom of a human tendency to control ourselves on the most fundamental parts. However, this defence is critiqued with the core question of Section 3.1: How do treatment and enhancement differ? If anything, this argument also classifies genetic diseases as natural, but we do not think of treating them as *contradicting our nature*. Therefore, this argument shows the necessity of a strict distinction but also that other principles can outweigh this objection. Secondly, this argument relies on an obligation to nature that is offended against, neither of those assumptions are necessarily true (Kamm, 2005).
Schwartz (2005) alternatively provides an argument to distinguish treatment and enhancement because one would be open to all virtues of *healthy* human life and accept the *normal*. Accordingly, health is grounded in the BST definition. This circular argument shows us that the fundamental assumption on the definition of *normative healthiness* is one still to be answered (Schermer, 2013). We are left behind, relying on our intuition.
Furthermore, these justifications for a distinction exclude how one achieves ability. However, enhancement through a better diet, going to the gym or studying are seen as legitimate ways to enhance, even if someone already can fulfil minimal goals or has an ability above average (Allhoff et al., 2010, pp. 7-9).

3.3 *The Impact of Brain Stimulation*

Not only is philosophical discourse affecting the discussion on brain stimulation, but brain stimulation also affects discourse in return. I want to raise two concerns here on the changes of *normal* by the implementation of brain stimulation.
Firstly, the concern is that everyone enhances in similar patterns because humans have a convention in which traits are regarded as valuable over other traits that give value to humans in general (Kamm, 2005). Exactly the variety in human traits we appreciate may be undermined if everyone complies with the same standard. This, then, not only raises the bar for everyone to keep up (see Section 2.3) but also alters *normal* to be less variable than our current understanding.
Secondly, a more extreme concern, is that the definition of a normal human will be split. Accordingly, you would have a *normal unenhanced human* and a *normal enhanced human*. For instance, creativity may be a valuable trait and people that are unenhanced are given fewer opportunities to interact with enhanced humans (Anomaly, 2020, pp. 13-17). However, this extends the impact of brain stimulation way beyond what is reasonably promised at this point.

4 CONCLUSION

In this paper, I offer a case on the ethical considerations of brain stimulation, as well as on contemporary and future impacts of normality.
Firstly, I discussed the ethical considerations. In doing so, I argued brain stimulation undermines informed consent, but more fundamentally also has the potential to change character traits and their appreciation, increase distributive injustice within society and coerce people into participation. Even if enhancement has some benefits, it should be weighed against these points. To that end, the question becomes: How much brain stimulation goes beyond normal?
Secondly, I considered the assumptions underlying the ethical considerations. I exposed how they are grounded in our ideas of *being healthy* by considering multiple definitions. It is unsatisfying that no definition is successful in capturing enhancement and the intuition that we hold. This either means our intuition is wrong or that we have work to do. On top of that, I considered arguments for and against the distinction of treatment and enhancement and showed how these arguments rely on assumptions, use circular reasoning or exclude the way in which one achieves enhancement. Lastly, I considered the possible impacts of widespread brain stimulation on assumptions of normality.

I hoped to end this paper with an answer to the question: Ought we continue the implementation of brain stimulation? However, during my analysis, I have not encountered a reasonable case against it. Even though intuitively I think the raised ethical considerations are important, they are grounded in assumptions that simply do not hold in the existing literature (cf. Synofzik, 2009). I regard this as a point for future work.

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