An Ethical Argument for Regulated Cognitive Enhancement in Adults: The Case of Transcranial Direct Current Stimulation (tDCS)

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ABSTRACT

Abstract— Human enhancement consists of methods to surpass natural and biological limitations, usually with the aid of technology. Treatment and enhancement are considered to be different in that treatment aims to cure an existing medical condition and restore the patient to a normal, healthy, or species-typical state whereas enhancement aims to improve individuals beyond such a state. This article aims to demonstrate the case in favor of the regulated use of cognitive enhancement by examining a technique called Transcranial Direct Current Stimulation (tDCS), while addressing common ethical arguments against cognitive enhancers as well as the ethical obligation for proper regulation.

Keywords: bioethics, human enhancement, tDCS, ethical enhancement, regulation

INTRODUCTION

Human Enhancement, Enhancement vs. Treatment

Human enhancement consists of methods to surpass natural and biological limitations, usually with the aid of technology. Treatment and enhancement are considered to be different in that treatment aims to cure an existing medical condition and restore the patient to a normal, healthy, or species-typical state whereas enhancement aims to improve individuals *beyond* such a state. However, the line between treatment and enhancement remains debatable. There is no one agreed-upon definition of the normal human condition; this definition depends on factors such as time period and location, among many. In fact, the debate stems from discussions about the scope of medicine and the definition of 'healthy.' For some, like Norman Daniels, a healthy state is the absence of disease whereas for others, such as the World Health Organization (WHO), it is "a state of complete physical, mental and social well-being."[1] These two definitions of a healthy state are clearly not identical and there exist similarly differing opinions on what is considered 'beyond' healthy, as well.[1]

This article aims to demonstrate the case in favor of the regulated use of cognitive enhancement by examining a technique called Transcranial Direct Current Stimulation (tDCS), while addressing common ethical arguments against cognitive enhancers as well as the ethical obligation for proper regulation. The case for regulated use is primarily articulated through a lens of safety and a comparison is drawn between enhancement and treatment in terms of cost-benefit analysis. Although the aim is to extend regulated use to other similar cognitive enhancers by showing tDCS as a case example, it would be wise to evaluate each technique individually.[1]

ANALYSIS

Cognitive Enhancement

Cognitive enhancement, also known as neuroenhancement, is the improvement of cognitive functions such as memory, attention, wakefulness, and alertness.[2] Cognitive enhancement can even include drinking coffee or doing memory-training exercises, and thus achieving improvement through natural or more traditional means. On the other hand, the term is also often used to refer specifically to technologies developed for improving cognitive capacities, such as the use of Attention Deficit Hyperactivity Disorder (ADHD) drugs without having the medical condition. Cognitive improvement is particularly controversial since we do not have a firm grasp of how the brain works, in neither its healthy nor diseased state. Furthermore, there is no straightforward, quantitative, and objective way to define mental diseases compared to other medical conditions. We cannot test for depression as easily as we can for cancer. Likewise, for traits such as introversion, it is hard to measure and determine if it is within the natural range.[3]

The current regulations for defining normal cognitive function are not optimal. For instance, while the Diagnostic and Statistical Manual of Mental Disorders (DSM) is used to diagnose mental illness, there are individuals who suffer from psychological diseases without fulfilling the designated criteria and vice versa.[4] This lack of clear, universally agreed-upon criteria makes it difficult to establish what counts as an improvement 'beyond' a healthy or normal range. Our cognitive qualities, such as shyness, are also closely associated with our personalities, so improving one's muscle strength and one's mental capacities are not considered to be equivalent. Of course, the controversy around the acceptance of either form of enhancement, physical or mental, is also due to disagreement over the methods used to achieve enhancement. Regardless, the use of technology to improve cognitive capacities is always received with more skepticism and concern than the use of technology for other types of enhancement.

Safety: a cost-benefit analysis

One of the most pressing concerns of any technological enhancement is safety. Ever since the Hippocratic oath, non-maleficence has been one of the central tenets of bioethics: "first, do no harm."[5] Since many of the currently proposed neuroenhancers consist of drugs for disorders like ADHD, which have side effects, an argument can be made that their use for enhancement can never be ethical. This view conflates enhancement practices with the burden of performing surgery on someone who does not need the procedure, as is the case with voluntary cosmetic surgery. Defining need becomes an important question.

However, an evidence-based comparison of advantages and disadvantages of a particular enhancement may show the benefits derived to be so great that they offset the harm. This is generally how medications for disorders are evaluated. For instance, although chemotherapeutic drugs have serious harmful side effects, they do more good than harm by successfully battling cancer cells.[3] Naturally, compared to cancer drugs, the benefits of enhancement techniques would need to be greater and the harm smaller, since there is not a deadly disease in the picture, but this does not exclude the possibility of making a comparative evaluation. Some bioethicists thus argue that enhancement should be permitted to be tested in the same way as current medical technologies.[6] Situating enhancers within a similar framework as that of medications can be beneficial for regulation purposes too, as will later be discussed for tDCS. The medicalization of cognitive enhancement would come at a cost and may result in over-regulation, as is the case with many medical issues today. Medicalization and regulation may limit accessibility, yet it would be irresponsible to do so since the creation of a black market would be inevitable.[7] We should carefully focus on how enhancements can be regulated in a similar manner to medical items since both affect human capacity and health, even if enhancers don't intend to cure per se.

Transcranial Direct Current Stimulation (tDCS)

tDCS is a good case example to explore the possibilities of cognitive enhancement. Greely and others see great promise in the future of cognitive enhancement, but since chemical drugs are currently the most well-known neuroenhancers, their significant side effects prevent progress from the start.[6] These effects include addiction, headache, and blood pressure changes. Furthermore, the short- and long-term effects of these drugs, for the most part, have not been tested for healthy individuals since they were designed to treat diseases; the sheer lack of knowledge calls for caution.[8] On the other hand, tDCS belongs to another class of interventions called neuromodulation and has a completely separate mechanism of action.

Neuromodulation is the application of electricity to modulate brain function. There are various kinds of neuromodulation that work with different mechanisms than tDCS. Transcranial magnetic stimulation (TMS), for example, is a technique that uses electricity to induce a magnetic field and thus manipulate function. tDCS, on the other hand, uses electricity to facilitate the firing of neurons, i.e. increase excitability. tDCS consists of the application of low intensity (~1-2 mA) currents positioned to be passed between scalp electrodes for around 20 minutes. The effect is directional; anodal stimulation (current that flows from anode (+) to cathode (-)) results in enhancement, whereas cathodal stimulation would do the opposite.[9]

tDCS increases excitability and plasticity.[10] Experiments have also shown post-application changes in learning and memory processes. Overall, numerous studies cite the enhancement effects of tDCS in "motor and sensorimotor skills, vision, decision making and problem solving, mathematical [abilities], language, memory, and attention."[11]

tDCS carries many more positive qualities, such as being non-invasive, portable, well tolerated (pain-free), relatively inexpensive,[11] and having potential long-term effects (up to 12 months).[12] Still, the most important and unique quality for the focus of this paper is its safety. The usual disadvantage of neuromodulation techniques is the risk of seizure and yet to this day, there has been no documented case of seizure with tDCS .[9] Nevertheless, this is not to say tDCS is incapable of causing harm. Iuculano and Kadosh found the "mental cost" of tDCS, which showed that an enhancement in a certain function was accompanied by impairment in another. For instance, application to the posterior parietal cortex improved numerical learning, while automaticity for the learned content was impaired.[13]

The Case for Regulated Cognitive Enhancement

The imperfection of tDCS is far from a valid reason against cognitive enhancement. Instead, it is an example of the need for proper regulation, which is to treat enhancement devices the same as medical devices. The current availability of tDCS devices demonstrates the case in favor of properly regulated access. Right now, there are two ways a healthy individual can obtain a tDCS device. For one, he can simply do it himself since there are many do-it-yourself (DIY) communities sharing information on this topic online. The risks are manifold for this approach; the effects of tDCS, like other neuromodulation techniques, depend significantly on dosage, position and other parameters. Even a mistake as simple as changing the direction of the current can result in a complete reversal of the effect. The ease of production of a tDCS device, including its relative cheapness, as well as the ease of use show that not offering an official, tested, and approved version of tDCS can do more harm than good.

Alternatively, a healthy individual can buy a tDCS device from one of the several commercial companies that produce them. A look at the frequently asked questions webpage of one of the most popular tDCS device companies, foc.us, shows the potential complications clearly. Foc.us is designed for gamers to improve mental skills for gaming performance, such as focus and reaction time. For the very first question on their webpage, the question about Food and Drug Administration (FDA) approval, the answer is "No. The foc.us gamer headset offers *no medical benefits, is not a medical device, and is not regulated by the FDA*."[14] As for safety, they state, "the foc.us headset has been tested to all required regulatory standards including…."14 Although these statements are correct by current standards, the headsets are as safe as they sound. Because they are not regulated as medical devices, the safety standards that they must adhere to are very low and, in fact, consist of only product safety regulations. The problem is not with the company or the customers, but with the regulations.

The foc.us device is designed for and marketed to gamers, but there is no way of controlling who uses it or for what purpose, creating a health hazard. Just like any other electronic device, it will also be good for use for quite some time, increasing the possibilities for usage. [11] Of course, even if it is used exclusively for improving gaming performance, it remains a health hazard because it does affect a biological capacity in a significant way. Foc.us thus neglects to account for the full spectrum of effects of tDCS. Iuculano and Kadosh demonstrated that the enhancement of one function was achieved at the expense of another.[13] Individuals need to receive proper counseling or a sufficient level of guidance before they sign up for altering one of their cognitive functions. Then, individuals can decide how to proceed; this process would be similar to making an informed medical choice. Devices such as tDCS should not be allowed to remain on the market as a non-medical device. They do not "cure" a disease in the traditional sense, but they do alter the workings of one's brain, which is arguably different than the effect a computer or a calculator has on a customer. In fact, FDA's official website provides a definition for medical device along the same lines: "*intended to affect the structure or any function of the body of man or other animals, and which does not achieve its primary intended purposes through chemical action within or on the body of man or other animals and which is not dependent upon being metabolized for the achievement of any of its primary intended purposes.*"[15] The only crucial detail not included in this definition is how such a medical device can have the described effect on an individual in the absence of disease, without the goal of curing a medical condition.

From an ethical standpoint, it can be considered the *responsibility* of medicine to provide this type of "enhancement counseling" to individuals who would be considered healthy by medical standards. The debate returns to how we define health, whether it is absence of disease or overall well-being. There is also the issue of how we evaluate future harm, i.e. prevention of disease in relation to responsibility of medicine. If cognitive enhancers can cause harm to individuals, healthy or not, it may be medicine's duty to regulate them. The role of medicine cannot start only when the individual finds himself harmed, i.e. becomes a 'patient.' [1]

Previously in this paper, an argument against (cognitive) enhancement was discussed by referring to non-maleficence. Yet another traditional goal of medicine is to prevent foreseeable disease or injury and optimize the situation for the patient; in other words, beneficence.[16] Since unguided use of these tDCS devices can result in harm, and appropriate use can result in benefit, it is not ethical to allow such devices to go unchecked by an FDA-like agency. It is also paternalistic, against the autonomy principle, for doctors to refuse to discuss options of neuroenhancement with individuals. Autonomy in this context refers to the right of an individual to make choices about their cognitive capacity. A doctor's responsibility depends on a mutual relationship between the 'patient' and the doctor, and the patient's wishes for what happens to her body. Autonomy does not override non-maleficence and beneficence but in case of tDCS and devices of the same safety caliber, supplements non-maleficence and beneficence principles as well. When the risk-benefit analysis of tDCS, as discussed above, results in more benefit than risk, the doctors would be disrespecting the autonomy of the individual by rejecting offering this method of enhancement simply because it is not a cure for an underlying disease or disorder.[16]

CONCLUSION

tDCS and Beyond

In conclusion, tDCS proves to be representative of many possible cases where the enhancement technique may not result in significant negative side effects. However, tDCS still has effects on cognitive capacities. It is therefore not appropriate for it to go unchecked by an agency similar to the FDA, if not the FDA itself, simply because it does not address an existing disease. Regulation by an FDA-like agency would be focused on making it safer for use. The potential users would be aware of the pros and cons, especially of the fact that they are changing their cognitive capacities.

It is important to make sure this regulation does not result in a barrier to use since especially through DIY methods, it is not impossible to manufacture these devices in the comfort of one's home. For better or worse, the idea and practice of cognitive enhancement has been accepted by parts of society and regulation will guarantee responsible use.[3] More regulation can also be seen as overburdening the already busy healthcare

system but cognitive function is not a light matter and is worth the time and effort to protect it. Furthermore, a discussion of the goals and principles of medicine as well as of the definition of health shows ample reasoning in favor of medicine assuming responsibility in the regulation and administration of tDCS and similarly safe techniques.

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