HIGH SCHOOL EDITION
Journal of Student Research
Volume 14 Issue 1 (2025)

The Ethical Considerations of Brain Computer-Interfaces

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ABSTRACT

Brain-computer interfaces (BCIs) were developed in the late 20th century as computer systems that use inputs from brain signals to command a device in the user's external environment. BCI technology may have a powerful impact on the lives of individuals with disabilities that inhibit their movement or communication; users have the opportunity to interact with their physical environment and community through these assistive devices. However, as BCIs emerge as revolutionary tools in biotechnology, they raise an onslaught of ethical considerations. This paper addresses the potential benefits and harms of BCI using the work of Immanuel Kant and Francis Fukuyama as primary guiding philosophical theories. This paper analyzes how BCIs can restore personhood and autonomy in those with disabilities that hinder their connection to their bodies. Simultaneously, this paper discusses how BCIs may undermine personhood and autonomy if enhancing the user's capabilities past natural human function. This paper analyzes how BCIs used for enhancement purposes may affect perceptions of legal and moral responsibility, boundaries on normality, and the foundations of human nature and dignity. This paper argues that while BCIs have the therapeutic potential to bring those with disabilities closer in touch with their humanity, they threaten to undermine the human rights and dignity essential to a functioning society if used extensively for enhancement.

Introduction to Brain-Computer Interfaces

Initially tested on animals in 1969 and 1970, brain-computer interfaces were first implanted into humans in 1998. BCIs enable communication between electrical signals from machines and target sites in the human brain. BCI systems require a BCI electrode, attached to or implanted in the brain, a computer that processes brain activity, and a device that is influenced by feedback from the computer. In the past few decades, researchers have made advancements in BCIs that allow users with disabilities to control prosthetic devices, restore communication, and utilize other technologies in their environment to perform daily tasks. Additionally, BCIs provide opportunities for members of service to operate drones and machinery through their brain activity instead of through manual operations. However, BCI use raises safety, privacy, and ethical issues that have led to many debates amongst scientists, philosophers, and the public.

Legal and medical boundaries of BCI use are yet to be established, but are essential to ensuring that BCIs do not cause physical or emotional harm to patients, or undermine human nature and ethical values.

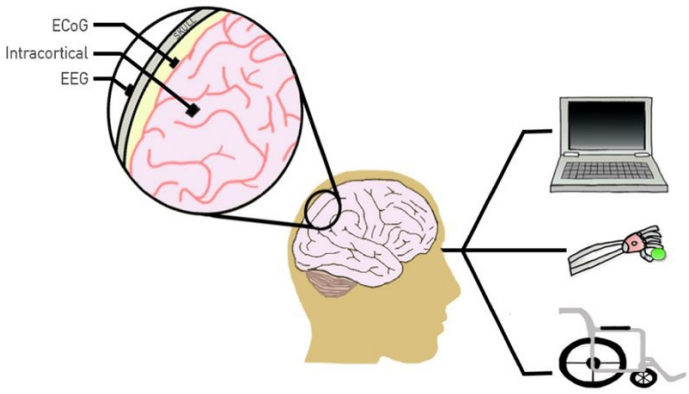

Figure 1. Diagram of BCI system connecting electrode to devices

Potential Benefits of BCIs to Personhood and Autonomy

In enabling individuals with disabilities to interact with society normally, BCIs may aid in restoring their personhood. Disorders such as autism and Parkinson's can inhibit natural communication and movement, while mental health issues can cause disruptions to "normal" emotional consistency. A loss of the ability to communicate can impact one's social connection to others, which is crucial to a sense of personhood. Similarly, restricted movement and emotional instability can threaten one's sense of self and humanity. BCIs allow users with movement impairments to interact with their physical environment, enabling a restoration of normal human function. Furthermore, users with limited ability to speak may be empowered to communicate with others through BCIs, and ultimately feel more connected to their community and selves. In this way, the benefits of BCIs for therapy use may be significant in aiding those who are already disconnected from their personhood due to their disabilities.

BCIs also have the potential to enhance the human dignity of those with disabilities through increased autonomy. Kant considered moral agency – the ability to set one's means in accordance to moral law – crucial to how he defined humanity. Disorders such as autism, Parkinson's, spinal cord injury, and stroke, that often inhibit motor and communication abilities, may undermine the autonomy of a person by preventing them from acting in accordance with their desires. BCIs have helped many achieve increased autonomy through giving them control over their environment and communication; a former user of BCI explained, "I felt like I could do anything…I could drive, I could see people, I was more capable of making good decisions – not bad decisions." As Kant believes that this autonomy is fundamental to the intrinsic worth and dignity of human nature, one could claim that BCIs reinforce the dignity and humanity of those with disabilities who lack autonomy without the assistance of technology.

Harms to Personhood and Authenticity

However, despite its potential to increase authentic personhood in disabled individuals, BCIs can result in adverse, counterproductive effects to personhood by blurring the line between a user's authentic self and the machine's influence as an extension of their body. For example, BCIs in the form of a closed-loop deep brain stimulation (DBS) can be used to treat depression and other mental health issues. Electrodes are implanted in a patient's brain to pick up on shifts in their mood and alter the mental state of the patient accordingly. DBS is largely considered to be a form of

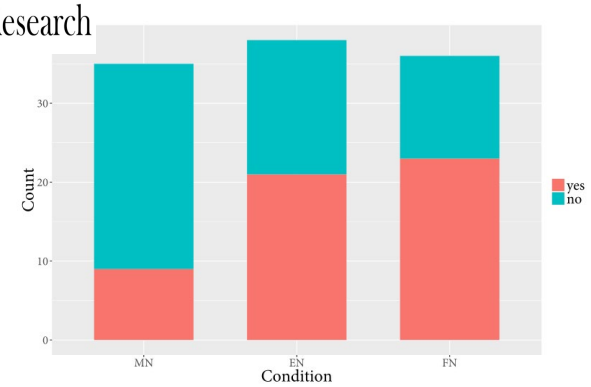

Figure 2. A graph demonstrating the number of participants in Hindricks and Douven's experiment open to using the experience machine, experience pill, and functioning pill.

therapy for those with mental health disorders. However, one might argue that, if a patient experiences a negative emotion that is context-appropriate – i.e., sadness at a funeral – the effort of the BCI to "correct" their mental state to a positive feeling is not one of therapy but of enhancement: allowing the patient to experience purely positive emotions rather than the natural range of human emotions that is considered normal. With this process arises the issue of whether such technology will affect a patient's sense of identity and self. If their feelings are not their own and instead curated by technology, they might not be able to decipher whether their thoughts and actions are the BCI's or their own; it is in this way that this technology may undermine their sense of identity.

Authentic personhood is essential both to individual satisfaction and to how humans connect with each other on a larger scale. Robert Nozick's experience machine and the results from Hindriks and Douven's experiment on the same machine alongside theoretical pills is a prime example of the value the majority of people assign to authenticity. Hindriks and Douven compared the openness of participants to engaging in three theoretical choices: the experience machine, the experience pill, and the functioning pill. The experience machine guarantees participants the ability to only undergo constructed, pleasurable experiences within a machine; the experience pill guarantees similar pleasurable experiences, though participants remain grounded in their normal physical environments; the functioning pill offers participants the ability to improve the quality of their cognitive and physical abilities, without influencing their experiences to any extent. As Hindriks and Douven predicted, out of the participants in their experiment, a much higher percentage were open to taking the experience pill than the machine, and the highest percentage of participants agreed to take the functioning pill. The more authentic or "in contact with reality" an option seemed, the more participants were inclined to accept the offer. This data illustrates how greatly participants valued living an authentic experience. Moreover, Fukuyama argues against the eradication of natural emotions and identities, claiming that "our ability to experience these emotions is what connects us potentially to all other human beings, both living and dead." In this way, personhood and authenticity are not only valuable to individuals themselves but also to how humans connect to others; once BCIs cross into enhancement territory, cautionary measures must be taken so that they do not undermine human identity and personhood.

Harms to Autonomy and Responsibility

As with personhood, the autonomy of users is likely to be challenged if BCIs are used for excessive enhancement. Autonomy becomes an ethical concern of BCI devices when users are "passively out of the decision loop" and stimulations from implanted devices occur without their influence: for example, DBS producing emotional responses in patients. When machines take partial control over a user's actions or thought processes, they risk imposing on free will. Though there is much debate about whether free will exists, Calum MacKellar in his Cyborg Mind argues that

the concept of free will is essential to democracy and a civilized society. Without some understanding of how humans make their own independent decisions, the meaning of voting, love, and interactions with others would be diminished. Furthermore, the aversion many have to being compared to zombies or robots illustrates how much humans value making their own decisions and not being determined by any other force. As mentioned previously, BCIs have the potential to increase autonomy in individuals that initially lack autonomy, allowing them to act according to their desires. However, when BCIs extend past therapy purposes, enhancing capabilities beyond the normal human capacity, the machine often has more control than the person using it. For instance, the concept of DBS for treating mental health issues is freeing until the user is automatically fed positive emotions where it is appropriate to feel sad, and the user's autonomy is undermined. The patient simply wanted to be free of their condition, and did not ask for nor consent to being made "happy" all the time. As BCIs extend their uses past therapy, they pose a threat to the user's sense of their actions being their own, as well as the concept of free will.

As a result of their impact on autonomy, BCIs challenge current approaches to legal and moral responsibility. If a user's autonomy is undermined by an implant or device, they may no longer be expected to hold accountability for their actions. For example, detached assistive devices such as robotic arms are not connected to the user's body; therefore, if the user performs an illegal action through the device, the legal system must decide whether the BCI or the individual is held responsible. Another instance of legal confusion as a result of new technology arises with Robotic Autonomous Systems (RAS) in military technology; accountability becomes harder to establish as machines assume greater control in decision-making and combat. This ambiguity of responsibility, one may argue, provides an opportunity for users to take advantage of BCIs to act immorally without facing consequences. Even without legal considerations, if humans are seen as robots as opposed to autonomous beings, individuals may no longer feel obligated to act morally toward each other because they no longer feel that their bodies and actions are fully their own. If BCIs begin to be used as enhancement tools by the majority, a lack of autonomy may lead to a deconstruction of responsibility; to an extreme, a society of shameless harm may arise as individuals lose their moral conscience.

Influence on Normality

An increasing use of BCIs may gradually change perspectives on disability and normality as enhancement becomes the new norm. BCIs that regulate mood through DBS, for example, depend on established norms about emotions and emotional variance. Some disability advocates, however, have argued that disabilities are often socially constructed and only harmful to the affected individual due to "inhospitable environments" rather than the condition itself. There is a concern, therefore, that as BCIs begin to be used for enhancement purposes, the standard of normal will adapt to the technology, and the range of traits and conditions society perceives as disabled will increase. Individuals with disabilities, according to Wolbring and Diep, may be held to "ability expectations" due to a growing use of BCI devices. In this way, BCIs may also increase stigma for those who choose not to "fix" their condition with technology. However, the pressure to use BCIs may not be limited to those with disabilities; with shifts towards enhancement, humans functioning at a normal level will likely feel expected to receive the newest BCI implants in order to improve their abilities or master their emotions past a normal human capacity. As the standard shifts, society will experience an overwhelming pressure to keep up with the new normal.

Human Nature and Dignity

If the human standard changes and enhancement becomes the norm, BCIs will risk intervening with the foundations of human nature. Kant's emphasis on rationality as the basis of human dignity and nature falls short in that it neglects the emotional aspects of being human. A machine can be programmed to be rational and thus help a disabled individual think and act appropriately. However, a machine with a high level of rational thought is not necessarily equivalent to a

human being. Fukuyama strongly disagrees with an algorithmic, reductionist definition of humanity, claiming that the humanity is defined not only by capacity for reason but also by sociability and emotional variability. To Fukuyama, natural emotional responses and the capacity to feel a range of authentic emotions are crucial to human nature. BCIs can never emulate natural human feeling, and it is in this regard that machine capacity falls short. If BCIs are normalized as a means of enhancing normal human function, machines may start serving as unsatisfactory replacements for authentic human qualities: "genius, or ambition, or sheer diversity" are Fukuyama's examples of such qualities. Empirical data also stands in support of Fukuyama's argument: When interviewed, BCI users were uncomfortable with the concept of being part-cyborg. There are concerns that BCI influence could become so large that humans may evolve into a different species completely, a species adapted by technology. Ultimately, as BCIs advance, it is important that society does not lose the emotions and natural inclinations that are prudent to human nature.

Crucially, human nature is the basis of human rights and dignity; thus, if BCIs undermine human nature, they risk moving society even further away from humanity. According to Fukuyama, many of the rights acknowledged today are grounded in observations of how humans are "by nature"; for example, equality and reproductive freedom. An appreciation for human nature is also essential to the concept of dignity. Fukuyama considers "Factor X" the essence of all human beings that guarantees an inherent dignity dependent on human nature. Similar to Fukuyama, the President's Council on Bioethics discusses dignity as the factor that separates humans from animals. He explains that animals have no concept of responsibility to each other, and thus lack a sense of shared values or justice amongst themselves. Humans, on the other hand, understand each other as sharing a common dignity, and thus have a moral responsibility to respect this dignity in others. BCIs, like genetic engineering, have the potential to become the kind of self-modification Fukuyama warns against, a disruption to human nature and the human rights dependent upon human nature. As a result, society may enter a "post-human future" and lose the basis of human dignity to guide how individuals treat each other. This harmful modification of human nature is significantly more likely to occur as BCIs shift from being primarily assistive devices for people with disabilities to an opportunity for any average person to enhance themselves.

Conclusion

As with most advancements in the biotechnology revolution, the benefits of BCIs are intertwined with the harms. BCIs have the potential to aid the life quality and autonomy of those with disabilities through assisting movement and communication. However, this technology also may also undermine human nature and disconnect users from their bodies such that their identities and autonomies are threatened. In order for the benefits to outweigh the harms, one must approach BCIs with the preservation of humanity in mind. It may prove helpful to establish a boundary between therapy and enhancement when considering the ethics of BCIs. As BCI uses lean towards enhancement, this new technology poses more of a threat to personhood, autonomy, and humanity. The boundaries placed on BCIs must ensure that the systems are reinforcing humanity rather than suppressing it.

Acknowledgements

I would like to thank my teacher, Dr. Timothy Furlan, for guiding me as I wrote this paper. I am incredibly grateful for his course, Biotechnology and the Human Good, in which I gained the scientific and philosophical background necessary to embark on my research.

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