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Ethical Challenges of Neurotechnology with an Emphasis on Privacy

Tayebeh Al-Sadat. Mostafazadeh[1], Shahriar. Eslamitabaar[2*], Shirin. Shirazian[3]

[1] Department of Public International Law, NT.C., Islamic Azad University, Tehran, Iran
[2] Department of Health Law, Smart University of Medical Sciences, Tehran, Iran
[3] Department of Environmental Management, SR.C., Islamic Azad University, Tehran, Iran

*** Corresponding author email address**: Slamitabar.sh@smums.ac.ir

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Neuroethics, a field situated at the intersection of bioethics and neuroscience that has gained prominence in recent years, is founded upon centuries of debate concerning ethical issues related to the mind and behavior. In general, neuroethics addresses the ethical, legal, and social policy implications of neuroscience, as well as ethical issues arising from neuroscience research itself. Advances in neuroscience are increasingly challenging long-standing conceptions of the self and the relationship between individuals and society. In the current era of rapid digital transformation, neurotechnology has emerged as one of the most prominent and controversial innovations. Within the medical field, this technology offers opportunities for the treatment of numerous previously incurable diseases and disabilities. Brain implants can provide novel therapeutic approaches for neurological disorders such as epilepsy and Parkinson's disease and can improve the quality of life of individuals affected by paralysis or movement disorders. The exponential growth of interdisciplinary research, the commercialization of cognitive neuroscience, the increasing emphasis on ethics education, and growing attention to public understanding of science all highlight the significant role of neuroethics in contemporary neuroscience.

Keywords: *Ethics, Neurotechnology, Brain Implant, Neuroethics, Privacy.*

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1. Introduction

The term "neuroethics" has been used to refer to ethical issues related to child-rearing (Pontius, 1993), technological advances (Farah & Wolpe, 2004), and the neural foundations of moral thought and behavior (Roskies, 2002). Neuroethics and the domains it encompasses are continually expanding through an increasing number of studies addressing personal and social phenomena (Illes, 2003).

Drawing on the history of ethics in neuroscience and the rapid pace of progress in the neurosciences, modern neuroethics includes theoretical, empirical, practical, and policy-related issues at the intersection of neuroscience and bioethics. One way to classify these issues is to group them into four main domains, which were highlighted in the 2002 meeting entitled "Neuroethics: Mapping the Field": (1) the implications of neuroscience for concepts of the self, agency, and responsibility; (2) social policy applications that make new resources, such as health care and education, available to society; (3) therapeutic intervention through advances in clinical practice; and (4) public discourse and education (Farah & Wolpe, 2004; Roskies, 2002).

Advances in neuroscience and neurotechnology, along with the considerable powers they confer over the human mind and body, have generated serious concerns and have attracted the attention of legislators, ethicists, international organizations, and the human rights community. This study addresses concerns arising from the development of brain–computer interface technology and its effects on human rights, including privacy. It examines the multifaceted ethical considerations surrounding neural interfaces and analyzes their potential social impacts, risks, and the need for responsible innovation. Despite the technological, medical, and ethical challenges ahead, neural interface technology remains highly promising and has the potential to inaugurate a new era of medicine (Bublitz, 2024).

2. Study Method

The present study is a descriptive-analytical inquiry. It has been written with regard to the emergence of the modern science of neuroethics in academic circles and the publication of articles on this subject in reputable international journals, and through reference to these sources.

3. Ethical Framework

Historically, moral and legal responsibility has focused on the autonomous individual; that is, a person who has the capacity to deliberate or act on the basis of his or her own will and plan, without being subject to coercion. However, with advances in modern technologies, many “hands” may be involved in the operation of brain implants, including artificial intelligence agents that directly influence the brain. This external influence raises questions about the degree of control over the behaviors and actions of the individual in whose brain the implant has been placed. If implants influence a person’s decisions and behaviors, do they diminish that person’s autonomy? If so, can responsibility still be attributed to the individual? Responsibility is a complex concept used in both law and philosophy to describe the quality or state of being responsible. The various definitions offered for the term responsibility reflect different understandings of moral and legal responsibility prevalent in the Western world, as well as the ways in which this concept is intertwined with theories such as accountability, legal liability, culpability, and causation (Cabrera & Carter-Johnson, 2021).

3.1. Moral Responsibility

There are endless debates concerning what constitutes a particular form of responsibility, such as moral responsibility, as distinct from other kinds of responsibility. A general view of moral responsibility holds that a person is morally responsible when voluntary actions lead to morally significant consequences that render the person worthy of praise or blame. A causal relationship between the person and the consequences of voluntary actions is one of the principal conditions for attributing moral responsibility, known as the voluntary condition (Frankfurt, 1982). Another important condition is that the agent must know what he or she is doing in order to consider the possible consequences of the act, known as the cognitive condition. Thus, if a person is unaware that his or her actions will lead to a harmful incident, responsibility may be reduced. This condition of responsibility goes back to Aristotle, who argued that because ignorance is a form of involuntary action, it can eliminate or reduce moral responsibility. Another important criterion is the ability to choose freely to act in a particular way; therefore, a person who acts under external coercion cannot be regarded as responsible (Cabrera & Carter-Johnson, 2021).

3.2. Multiple Causes

The effect of brain implants on individual behavior and decision-making is not clear. Holding a person responsible for what another person has done, or for an event that is beyond his or her control, is generally unjust and unwarranted. Brain implants complicate the causal relationships between a person’s actions and their outcomes. Accordingly, the question arises as to whether a person can be morally blamed for an act resulting from a brain implant. An adverse technology-related event is usually the product of an accumulation of errors, biases, or negligence, or the result of actions by various individuals—and in some cases even algorithms—involved in the development, functioning, use, maintenance, and legal oversight of the brain implant. There are also persons whose acts or omissions may bring about a given outcome, including engineers, device manufacturers, clinic owners, users, and even policymakers (Cabrera & Carter-Johnson, 2021).

The reality is that a particular outcome involves multiple factors, both human and nonhuman, each of which contributes in different ways to the emergence of that outcome; this gives rise to the problem known as the “many hands” problem (van de Poel, 2015). All of this makes it difficult to trace the chain of events leading to the occurrence. Is the algorithm at the core of the device’s functioning error-free? Do the manufactured components of the device operate in accordance with the technical specifications of medical equipment? Is implantation properly performed in medical centers, and is the device programmed with precise neural targets? Does the implanted individual observe the relevant dos and don’ts?

3.3. Attention to Consequences

Another important aspect of moral responsibility is the agent’s ability to attend to and deliberate about the consequences of his or her action. It is not clear what outcomes brain implants produce, how individuals experience and understand the world with them, or whether these implants relevantly affect the described conditions of responsibility.

Brain implants are complex technologies, with users and surgeons who often have incomplete knowledge of the assumptions, models, and theories concerning how these operations function. These issues become more pronounced when the implants are closed-loop devices equipped with machine-learning capabilities, in which case even their developers may not have full knowledge of the background processes behind their decision-making, or when brain implants possess capacities that increase the possibility of tampering or hacking (Edward, 2018). As the philosopher John Ladd aptly described, new technologies have created new modes of conduct and new social propositions, new forms of vice, new virtues, new ways of helping others, and new ways of exploiting others (Bechtel, 1985; Stahl, 2006).

3.4. Freedom of Action

Another important condition for attributing moral responsibility is freedom of action, which in moral philosophy generally presupposes that the person has free or autonomous will (Fischer, 1999). A person can be considered morally responsible when he or she has the capacity to control behavior on the basis of valid reasoning and motivation. In general, a person who acts under coercion or control is not considered responsible. Brain implants can influence human actions and attitudes by affecting persons’ decisions, facilitating and enabling particular forms of human cognitive processing, while also restricting or preventing persons in this regard (Cabrera & Carter-Johnson, 2021; Glannon, 2012).

The concept of autonomy in bioethics and philosophy is not without ambiguity. However, it generally refers to the capacity to reflect or act on the basis of one’s own desires and plans rather than as a result of external compulsion (Glannon, 2012). Research has shown that individuals can be easily controlled and influenced, whether through external elements, such as coercion by another person, or internal elements, such as addiction and mental disorders. Nevertheless, direct brain interventions appear unique because such interventions may bypass individuals’ conscious awareness, even in decision-making concerning whether to follow an action. In this respect, brain implants add a complex layer to determining whether the individual has acted freely or autonomously, or whether the implant has exerted sufficient influence to call into question the freedom of behavior and individual choice. If the device is not directly controlled by the agent, the case becomes similar to manipulation, the cause of which is inappropriate and unclear (Cabrera & Carter-Johnson, 2021).

3.5. Shared Responsibility

Moral responsibility has mainly concerned human action, intention, and its outcome (Fischer, 1999). Moreover, since Aristotle, moral responsibility rooted in the Western tradition has initially focused on individual responsibility. However, there are cases in which several agents are involved in a matter, making it difficult to identify an individual agent as the responsible person. Shared responsibility includes several individuals involved in an outcome, a situation in which it is not possible to determine the causal contributions of individuals and the distribution of responsibility among perpetrators separately rather than collectively (Nollkaemper & Jacobs, 2013). Shared responsibility has been reflected in ethical and legal literature, often in discussions concerning states and organizations. Although shared responsibility may be useful in cases where causation is not regarded as the fundamental basis of responsibility, various questions arise. If multiple persons bear shared responsibility for an event resulting from their actions, what factors affect the degree of responsibility of each person? When multiple persons are involved in the outcome of a joint act, it is not clear how much of that act each person is responsible for. With respect to brain implants, do human and nonhuman persons share responsibility? If the answer is affirmative, what factors affect the degree of responsibility of each agent, whether human or nonhuman? For example, if a brain implant does not function properly, it may be easy to determine which agent bears the greatest responsibility. However, where the brain implant is autonomous, it is not easy to identify the responsible person or to determine whether the implant itself had the greatest role in the final state of the action (Cabrera & Carter-Johnson, 2021). Just as this issue applies to the natural foundations of individual moral responsibility, it also applies to shared responsibility. Some argue that shared responsibility requires shared goals, whereas others maintain that this responsibility is based merely on shared benefit. According to the latter theory, it can be argued that persons equipped with implants also bear responsibility because they have used the device for their own benefit. Likewise, it can be argued that engineers, device manufacturers, and physicians, insofar as they are aware of potential risks and benefit from the sale and implantation of these devices, bear moral and legal responsibility when harm is caused by implants.

3.6. Agency

The concept of agency refers to "the idea of being able to do something that counts as an act or action" (Himma, 2008), as well as the ability to deliberate about these actions, that is, to interpret desires as intentions by combining them with beliefs. There are different forms of agency, including rational agency, but the present discussion concerns only moral agency.

Agency is philosophically intertwined with autonomy. Moreover, autonomy and moral agency go hand in hand in responsibility. When an agent acts autonomously, "it is not possible to hold another person responsible for the agent's actions" (Chinen, 2016). The relationship between agency and responsibility is explicitly expressed in Section 2.01 of the U.S. Model Penal Code, which provides: "A person is not guilty of an offense unless his liability is based on conduct which includes a voluntary act or the omission to perform an act of which he is physically capable."

4. Brain Implants as Moral Agents

Moral responsibility is generally attributed to moral agents who, at least in Western philosophical traditions, are exclusively human beings, since they are the only beings that act intentionally and on the basis of free will (Hage, 2017). However, with advances in neuroscience, computer technology, and artificial intelligence systems, who or what should be designated as a moral agent has come into question (Bechtel, 1985). Some thinkers believe that as systems become more autonomous, humans will no longer be responsible for their behavior. Andreas Matthias characterizes this feature as the responsibility gap: "the actions of machines in various domains are increasing, and traditional methods of attributing responsibility are incompatible with our conception of justice and the moral framework of society, because no one has sufficient control over the actions of the machine to be held responsible for them" (Matthias, 2004). Others, such as Robert Sparrow, argue that "it is no longer possible to hold the programmer/designer responsible for consequences that they could neither control nor predict. The connection between the designer/programmer and the system's outcome, which forms the basis for attributing responsibility, is severed by the autonomy of the system" (Sparrow, 2007).

There are also thinkers who reject the responsibility gap by rejecting the "control requirement," which states that "a person is responsible for an action only if he or she had control over it" (Santoro et al., 2008). However, as Santoro and colleagues argue, control is not necessary for holding a person responsible, just as there are cases in which humans are responsible for actions beyond their control, such as cases of strict liability. Others also believe that engineers, developers, and programmers of brain implants are responsible for the behavior of the implants they have created, on the basis of the theory of professional responsibility, even if they do not control the behavior of their creation (Nagenborg et al., 2007).

Some thinkers regard this type of responsibility positively and emphasize "the advantage of attention, or the obligation to attend to the consequences of one's actions for others." However, to what extent can engineers, developers, and even physicians be expected to foresee and prevent the consequences of the use or misuse of their technologies or the technologies they have designed? The most effective way to view this issue is to understand responsibility as a social function by considering the resulting social consequences (Stahl, 2006), including the expectations it creates among members of society and the incentives it promotes for correcting or encouraging particular behavior.

5. The Framework of Neuroethics

Rafael Yuste, the neuroscientist, states that ethics is necessary, but that the basis of this governance framework for neurotechnology must rest on fundamental human rights. Mental processes are at the core of what makes us human, and Yuste has also expressed the need for these rights emphatically: "This is an urgent matter. This is not science fiction, and we urgently need some form of regulation. Technology is advancing. But if we do not act, we will find ourselves in a situation where it is too late to do anything. Many companies are now working on devices that read brain signals to control robotic equipment and encode the goals and intentions of thoughts" (Yuste et al., 2017).

6. Discussion and Analysis

Neurotechnology raises ethical questions that are connected to what we call our "self" or "soul," complex philosophical concepts with numerous presuppositions (Vogeley & Gallagher, 2011). Ethical discussion usually draws on the concept of personhood as a "modern" concept that includes the core aspects we normally attribute to our self or soul (Merkel et al., 2007). These aspects include self-awareness, responsibility, planning for one's individual future, and similar dimensions. In our analyses, we must first become aware of the concepts of "person" and "personal identity" as fundamental ethical concepts. The integrity and dignity of a person are the most relevant criteria for the ethical evaluation of technological interventions. The concept of personhood always has normative implications, because we do not merely describe certain characteristics and capacities of a person; rather, we seek to recognize, acknowledge, and safeguard them. For example, the principle of "informed consent," which is highly important in clinical practice, refers to the concept of personhood. Patients must consciously approve a neurotechnological intervention before it is carried out. In this respect, the concept of the person can provide an ethical criterion, assuming that we do not wish to impair personal capacities such as autonomy and responsibility through interventions in the brain. Neurotechnological interventions are not ethically acceptable if remaining a person is placed at risk. Current practices of neurotechnological intervention, explicitly and implicitly, are oriented toward the concept of personhood.

However, the situation is more complex, as is often the case in ethical evaluations (Schermer, 2011). Although a patient usually remains a person after an intervention in the strict philosophical sense of the word, he or she may be left with an altered personality, unfamiliar personality traits, and new or previously unconscious behavioral patterns. Through deep brain stimulation in patients with Parkinson's disease, an altered personality can be detected in many cases. Some changes are subtle, but they may also be very severe. We have observed the onset of depressive disorder that did not exist before the intervention. There are cases of disproportionate euphoria in patients who, before the onset of deep brain stimulation, were known for their "rational" behavior but now, for example, tend toward risky financial decisions. What we observe here is not so much a disturbance of personhood as changes in personality and personality traits.

Is the patient's personal identity threatened in such cases? The concept of personal identity refers to the question of the extent to which, and under what conditions, an individual remains the same over time beyond physical identity. Answering this question requires us to develop concepts and provide criteria that allow us to determine the "sameness" of an individual over time; nevertheless, this is a complex issue with ethical relevance. Not only interaction with other human beings but also appreciation of moral capacities—such as the ability to make a promise and act upon it—are rooted in the assumption that we and others remain, beyond any doubt, the "same." In the international debate on this issue (Baylis, 2013), there is an implicit assumption that even in the face of distinct and observable personality changes, personal identity is not endangered. Drawing on concepts of narrative identity, we can assume the "sameness" of an individual because human beings experience themselves as the same through the narration of their life history. Even significant ruptures caused by illness or a disabling treatment such as deep brain stimulation are understood as an integral part of the individual's own history and identity. In his book Deep in the Brain, the sociologist Helmut Dubiel describes his personal experience with Parkinson's disease and deep brain stimulation (Dubiel, 2009). His attempt to understand the technology in his mind and how it affects his daily life can be regarded as an example of how neurotechnology is integrated into a person's life, experiential horizon, self-concept, and self-image. Even in such an extreme case, personal identity is by no means called into question. Despite all personal distortions and strange experiences, Dubiel remains who he was.

However, there are also examples in which this stability can no longer be assumed. The medical ethicist Walter Glannon describes the story of a patient who, after deep brain stimulation, entered a state of euphoria to such an extent that his family could no longer recognize him as the person they had previously known (Glannon, 2009). Yet the patient himself was very happy in his condition; not only were the negative symptoms of Parkinson's disease largely suppressed, but as a result of stimulation-induced mania, he also felt "happier." When a decision had to be made about admitting him to a psychiatric institution because he could no longer live independently, several dilemmas became apparent: in which "state" should informed consent for treatment be obtained from the person? Should the patient be consulted before or after stimulation in cases such as the one reported above? Which of the patient's "states" qualifies him as "self-responsible"? We must also consider the family environment and the health-care system: how much "alienation" must relatives accept? Should society pay the costs of hospitalization?

The situation described by Walter Glannon is certainly very severe and fortunately occurs very rarely. From an ethical perspective, it will be important in the future to understand precisely the subtle and less subtle changes caused by neurotechnological interventions in the brain in order to formulate generally accepted ethical standards. This requires the integration of several perspectives. Qualitative and quantitative psychological assessment of personality changes is one of them. However, we also need new descriptive categories to understand the characteristics of a technology that has the potential to affect the everyday lives of many people. Patients must learn to "switch" regularly between different states of their personality, because the stimulator can be turned on and off by pressing a button. Neurotechnological intervention concerns our self, which is not merely the result of our brain activity but arises from the interaction between our body and the world, including our social and cultural environment. For this reason, the ethical evaluation of neurotechnologies must also include a critique of what is called "neuroreductionism" or "neuroessentialism." The self, the "I," and the person are more than the brain and its functions. An anthropological critique of reductionist positions is also ethically relevant in view of the multidimensional and anthropological concept of personhood. Despite the large body of neurobiological knowledge about pathological processes in the brain, we are still dealing with persons who suffer from an illness, not merely with a dysfunctional organ. This is also of great importance for clinical practice. If the brain is treated as an isolated organ in the treatment of disease, and our self is regarded merely as an "appendage" of brain activity, it can easily be forgotten that different forms of treatment must be integrated here. Interventions made possible by neurotechnology are ethically justifiable if, and only if, they result in the successful treatment of very serious brain diseases. However, in the future, ethical evaluations must also take into account the "mechanization" of the self through neurotechnological interventions and its consequences for the everyday lives of human beings. In this respect, we will enter unknown territory that must be thoroughly examined.

7. Conclusion

Confronting the consequences of neurotechnology may require not only the development of specific policies, laws, and instruments but also the strengthening of organizational structures to ensure the effective implementation of preventive and mitigating policies. Such frameworks must be sufficiently flexible to provide rapid responses to unconventional forms of violations, because risks and impacts may evolve and change over time.

Our analysis reveals three new issues related to responsibility and brain–computer interfaces. We examined the different ways in which interfaces expand or reduce the scope of moral responsibility and explored the problems related to the distribution of responsibility in relation to interfaces. The development of interfaces began with therapeutic promise, but the entertainment industry and others have rapidly adopted this technology. Therefore, interfaces are likely to become a common feature of future societies. The novel aspects of the interfaces discussed above—control of external objects, unconscious stimuli, and mind-to-mind communication—mean that current concepts of moral responsibility may not be easily applicable. Certainly, the increased knowledge enabled by interfaces will probably expand our responsibility. Physicians, soldiers, scientists, and ordinary drivers can receive feedback on their activities and information in order to guide their choices, allowing them to act more responsibly. In addition, the ability to control external objects through nothing other than our thoughts will increase our responsibility, because our power to influence the world will increase significantly. People will have greater control over their environment and more knowledge for decision-making.

However, serious issues must be addressed. It is necessary to ensure that interfaces are not vulnerable to hacking or external mind control. The idea that hackers, governments, or corporations could send signals through interfaces to control users' thoughts and actions gives rise to disturbing possibilities. This not only threatens the possibility of responsible action, privacy, and freedom, but also endangers the potential satisfaction derived from the presence of these values. It must also be ensured that interfaces do not respond dangerously to unconscious thoughts. A vehicle controlled by an interface in response to an angry impulse has the potential to cause a disaster. Therefore, late-stage security measures may be needed in some interfaces.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

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Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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