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NEUROTECHNOLOGIES AND NEURO-ENHANCEMENT ETHICAL CHALLENGES

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Abstract
Introduction. Neurotechnologies include specific devices and procedures for accessing, monitoring, investigating, evaluating and manipulating the structure and functioning of the human brain. Neurotechnologies may also be used for enhancement purposes, i.e., neuro-enhancement, in order to increase the individuals' mental and physical capacities. *Material and methods*. In this paper, the authors analyze, based on the literature data, the ethical challenges raised by the use of neurotechnologies for enhancement purposes of the human being. *Results*. The ethical analysis of neuro-enhancement starts from the blurring boundary between therapy and enhancement and is polarized between arguments in favor and arguments against this application of neurotechnologies. Neuro-enhancement is supported by arguments such as: the possibility of accelerated development of human species and of the individual, but also the right of the individual to choose freely. At the opposite pole, neuro-enhancement is seen as a threat to human dignity, an attempt to go beyond the limits of nature associated with risks that are still insufficiently known. Neuro-enhancement has also the potential to deepen social disparities and inequities and to create social pressure in the sense of accepting these neurotechnologies, with the annulment of the individual's free will. *Conclusion*. Neurotechnologies designed to enhance the human being are still in their infancy. However, given the major implications they can have on individual identity and on the evolution of the human species, these technologies must be evaluated and regulated ethically and legally in an anticipatory manner.

Key words: neurotechnologies, neuro-enhancement, ethics

Introduction

The brain is the central organ of our existence, which defines us as individuals cognitively, emotionally and as a personality. The importance of the brain is also demonstrated by the fact that currently brain death certifies the death of the human being (Chan & Harris, 2006; UNESCO, 2021). It is thus obvious the importance of knowing the human brain in all its complexity. The human brain represents the object of study of neuroscience which "aims at explaining human behavior and certain social norms (such as altruism, empathy, human behavior, free will) on a neurological basis, in order to increase our understanding about ourselves and other people" (Dubljevic´, Jox & Racine, 2017; UNESCO, 2021).

Neurotechnologies include devices and procedures that aim, on the one hand, to investigate the human brain (neuro-imaging), and on the other hand, to modulate or modify its functioning (neuro-engineering) (van Est, 2014). Neurotechnologies find their applicability both in the medical field and outside it, with various purposes, including for the enhancement of individuals. The application of neurotechnologies with the aim of enhancing individuals defines the field of neuro-enhancement, which will be approached from an ethical perspective in this paper.

Neuroenhancement - framing the field

Enhancement is "a deliberate intervention that aims to increase an existing capacity that most or all human beings commonly have, or to create a new capacity" (Focquaert & Schermer, 2015).

The idea of human enhancement is not new (Krutzinna, 2019). Some forms of enhancement, such as doping in sports or pharmaceutical enhancement of memory and attention, are already possible, and others may be available in the near future, such as the neurotechnologies aimed at increasing cognitive capacity (Giubilini & Sanyal, 2015).

Neuro-enhancement is defined as the use of neuroscience applications (medicines, devices or technologies) in order to increase the normal cognitive or affective functions of people (Focquaert & Schermer, 2015; O'Connor & Nagel, 2017; Krutzinna, 2019). Neuro-enhancement is different from other enhancement modalities due to the complexity of the brain functions and the effects of neuro-enhancement on behavior and cognition (Chan & Harris, 2006). Thus, neuro-enhancement has the potential to influence cognitive capacities (for example, memory and attention), affective states and physical capacities (for example, muscle strength), but also social and moral capacities and decision-making competence of individuals (O'Connor & Nagel, 2017).

While surgical interventions or different types of brain stimulation are still at a hypothetical or experimental level (Siipi, 2011), the off-label use of certain drugs with the purpose of neuroenhancement is a reality today. In this sense, we mention the use of modafinil, methylphenidate or dextroamphetamine by people who do not suffer from the pathologies for which these drugs are intended, in order to improve their cognitive performance (Goodman, 2010) or the administration of Prozac in people who do not have need for antidepressants in order to improve their emotional state and social life (Kraemer, 2011).

In addition to technologies that could have a profound and irreversible effect on the health and neurological identity of users (such as deep brain stimulation), interventions such as nutrition and cognitive training can also be included in the category of neuro-enhancement methods (O'Connor & Nagel, 2017).

Also, a new generation of non-invasive brain stimulation devices (NIBS) or Do-It-Yourself brain optimisers is currently gaining ground. These devices, considered *soft-neuroenhancers* (such as transcranial Direct Current Stimulation – tDCS) are gadgets that can be used to increase attention, relaxation, falling asleep, or faster acquisition of skills, such as playing a musical instrument (Brenninkmeijer & Zwart, 2017).

Moral enhancement represents a particular type of neuro-enhancement that can be achieved through interventions aimed at improving the moral capacities and moral behavior of individuals, such as the sense of justice, altruism, empathy, reducing aggression, etc. (Focquaert & Schermer, 2015). Traditionally, moral enhancement can be achieved through moral education, an available and proven effective method. Added to this, at least at the research level, are interventions using drugs and neurotechnologies (for example deep brain stimulation) to activate certain brain areas (such as the cerebral amygdala) (Focquaert & Schermer, 2015; UNESCO, 2021).

The bioethical framework for the analysis of neuro-enhancement

Neuro-enhancement can be an attractive option for individuals, in the idea that it could enable the achievement of health, happiness, economic success, etc. However, neuro-enhancement raises a multitude of ethical issues, from individual ones such as the safety and autonomy of users, to those of a social nature, such as justice, equality and health policies or the type of society that tends to be created by accepting methods of neuro-enhancement (O'Connor & Nagel, 2017).

Neuroethics[1], a distinct part of bioethics, deals with ”the examination of what is right and wrong, good and bad about the treatment of, perfection of, or unwelcome invasion of and worrisome manipulation of the human brain” (Safire, 2002). Neuroethics includes, on the one hand, *ethics of neuroscience,* that regulates and guides form an ethical perspective research in the field of neuroscience and the application of its results to humans, and on the other hand, *neuroscience of ethics*, which study the neurological basis of morality (Figueroa, 2016; UNESCO, 2021) .

Since the 1990s, the debate on the ethical, legal and societal aspects of neuro-enhancement has emerged and evolved in both the public and academic domains (Brenninkmeijer & Zwart, 2017).

The ethical debate on enhancement brings into discussion as a central element the distinction between *treatment* and *enhancement* (Krutzinna, 2019), the concept of *normality* being placed at the basis of this distinction.

Normality[2] is often understood from a statistical perspective (Krutzinna, 2019). Statistical normality is “a norm and goal” in medicine, meaning that what is above the lower limit of statistical normality is considered medically normal (Siipi, 2011).

Taking normality as a reference point, we can say that therapeutic interventions are aimed at restoring the body's normal functions, while enhancement interventions aim to increase a capacity of the body, which is already within the normal range for our species. The concept of normality is, however, ambiguous both descriptively and normatively. Descriptively, normality is defined in statistical terms (as previously shown) (Giubilini & Sanyal, 2015); however, what is statistically normal varies widely across places and over time, depending on different factors such as: nutrition, education, knowledge, or available medical interventions (Siipi, 2011). In a normative sense, normality refers to the observance of moral, social or cultural norms, by virtue of which a certain condition of the body can be considered normal or pathological. This ambiguity in the definition of the *normal* brings with it ambiguity regarding the distinction between therapy and enhancement, with some authors even considering that this distinction cannot be made (Harris, 2010; Krutzinna, 2019).

The ethical debate on the enhancement of the human being unfolds along a continuum placed between two poles where the supporters (bioliberals and transhumanists) and those who oppose (bioconservatives) these interventions are located.

Bioliberals and ***transhumanists*** advocate human enhancement technologies and argue that people should have the freedom to decide for themselves and their children.

At a first assessment, one might consider that if there is both individual and social benefit, the choice to freely accept neuro-enhancement must belong to the individual (Chan & Harris, 2006; Ioan et al., 2017). However, methods intended for neuro-enhancement raise questions about the safety of their use and how they might alter the behavior and decision-making ability of those who use them. For example, the use of cognitive-enhancing drugs calls into question the individual's ability to act and decide as an autonomous being, as well as the authenticity of the decisions individuals make and the values they promote under these circumstances (Chan & Harris, 2006).

The discussion regarding autonomy in the context of neuro-enhancement is particularly difficult in the case of children[3]. Parents can decide in favor of applying a neuro-enhancement method for various reasons, from treating a disease, to improving the child's capabilities as an intrinsic value or to give the child a competitive advantage, in accordance with the standards imposed by society (Krutzinna, 2019).

[1] The term *neuroethics* was introduced by William Safire (Safire, 2002).
[2] The idea of *normality* was introduced in the 19th century by Sir Frances Galton, thus marking the beginning of medicalization, according to which what is not "normal" must be treated (Krutzinna, 2019).
[3] *Pediatric enhancement* includes methods to shape children and improve their capabilities (UNESCO, 2021).

Children are, however, a vulnerable category in the context of neuro-enhancement. On the one hand, it is about the possible long-term effects of neuro-enhancement on a developing brain (O'Connor & Nagel, 2017). On the other hand, children have a developing autonomy, which means that decisions in the early stages of life are made on their behalf by others (usually parents). This means that children need protection against unjustified interference to promote their best interests (Krutzinna, 2019). At the same time, the moral acceptability of neuro-enhancement in children brings into question their right to an open future (Feinberg, 1980). Thus, decisions made on behalf of a child are wrong whenever they limit his ability to make his own choices as an autonomous adult. In this context, the American Academy of Neurology recommends a ”more conservative” approach in applying neuro-enhancement methods to children than to adults (O'Connor & Nagel, 2017).

The proponents of human enhancement consider that becoming post- or trans-human is an improvement of human nature, which has always been an ideal of humans (Giubilini & Sanyal, 2015; Brenninkmeijer & Zwart, 2017). In their view, human enhancement is a part of human development, whether achieved by natural or artificial means, is a shortcut, freely chosen by the individual, being acceptable in a free market (from a libertarian perspective) or a stage of evolution that allows same result with less effort (from a utilitarian perspective). More, enhancement gives people the ability to reverse the physical and social effects of the natural lottery. Such an approach even justifies the promotion of an individual and collective “obligation to enhancement” (Harris, 2010; Savulescu, Ter Meulen & Kahane, 2011; UNESCO, 2021).

Bioconservatives reject the idea of enhancement, arguing that it is likely to dehumanize human beings, who will become less authentic[4] and to create a more competitive and less fair society. Enhancement is considered a threat to human dignity, being an attempt to overcome the limits of nature.

Opponents of human enhancement raise the possibility of producing disproportionately large negative effects compared to the benefits, which makes these methods unethical, even if they are accepted or requested by individuals who should aim to exceed their capabilities naturally, through active effort (Kass, 2002; Fukuyama, 2006; Sandel, 2007; UNESCO, 2021).

Neurotechnologies are still marked by uncertainties[5], because we still know very little about the functioning of the human brain and the effects of interventions on an individual's mental capacities or behavior[6]. Therefore, neuro-enhancement risks and user safety must be carefully weighed against the benefits (Chan & Harris, 2006; Nuffield Council on Bioethics, 2013), and the use of these technologies in medical practice and for non-medical purposes must be done with great caution (Nuffield Council on Bioethics, 2013).

Another important aspect is the effectiveness of neuroenhancers. There are authors who question the very existence of a real problem raised by neuro-enhancement, while others predict that neurotechnologies have the potential to transform the human species into one of cyborgs or superhumans (Brenninkmeijer & Zwart, 2017).

At this time, the efficacy and scientific validity of many of the envisioned neuroenhancement methods are uncertain. However, the ethical issues related to neuroenhancement require a proactive approach, precisely because of the potentially

[4] One of the central arguments against neuro-enhancement is the threat to the authenticity of people, their actions and the decisions they make (Siipi, 2011).

[5] Animal research in the field of neuroscience provides limited physiological information, but not about the complex functioning of the human brain (Chan & Harris, 2006).

[6] For example, the administration of methylphenidate in people who do not suffer from ADHD causes an increase in attention and concentration, but at the same time, it reduces performance on tests of spatial memory (Chan & Harris, 2006).

important impact these techniques could have on individuals and society (O'Connor & Nagel, 2017).

Enhancement is also seen by its opponents as the result of societal pressure on individuals to conform to standards of mental efficiency in study, work, sports performance, etc. This is likely to determine the so-called enhancement divide, i.e., the division between the enhanced and the non-enhanced, which raises problems of social equity. Social pressure towards neuro-enhancement also touches upon the issue of eugenics, i.e., selecting the best based on neurocognitive characteristics (Kass, 2002; Fukuyama, 2006; Sandel, 2007; UNESCO, 2021).

Conclusions

Neurotechnologies are a burgeoning field that promises real health benefits for users. At the same time, the possibility of using neurotechnologies to enhance the human being reopens the debate on the ethical acceptability of human enhancement and enriches it with new challenges generated by the very particular importance of the brain as the central organ for our existence. Although neuro-enhancement is still at an early stage, this field must be carefully analyzed from an ethical, legal and social perspective and regulated in an anticipatory manner in order to be able to limit the possible unwanted effects that may occur when such interventions become reality.

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